TASCAM

TEAC Professional Division

BR-20 Series

1/4" 2-Track Recorder/Reproducer

OPERATION/MAINTENANCE

The guarantee provided for the BR-20 has several restrictions. The BR-20 will perform properly only if it is adjusted properly and we guarantee that such adjustment is possible. Setup is not covered by Warranty. If your attempts at internal adjustments are unsuccessful, we will charge you for readjustments.

Recording is an art as well as a science. As a result, your finished product may be judged more by artistic criteria than technical performance. Art is the province of the artist and TASCAM can make no guarantee that the BR-20, *by itself,* will assure the quality of your work.

Your skill as a technician and your abilities as an artist will be significant factors in the results you achieve.

Bescheinigung des Herstellers/Importeurs

Hiermit wird bescheinigt, daß der/die/das

MAGNETTONBANDGERÄT TASCAM BR-20

(Gerät, Typ, Bezeichnung)

in Übereinstimmung mit den Bestimmungen der

AMTSBLATT 163/1984, VFG 1045/1984, VFG 1046/1984

(Amtsblattverfügung)

funk-entstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

TEAC CORPORATION

Name des Herstellers/Importeurs

THE APPLIANCE CONFORMS WITH EEC DIRECTIVE 87/308/EEC REGARDING INTERFERENCE SUPPRESSION

CONFORME AL D.M. 13 APRILE 1989
DIRETTIVA CEE/87/308

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CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER (OR BACK). NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

This appliance has a serial number located on the rear panel. Please record the model number and serial number and retain them for your records.
Model number _____
Serial number _____

WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

SAFETY INSTRUCTIONS

CAUTION:

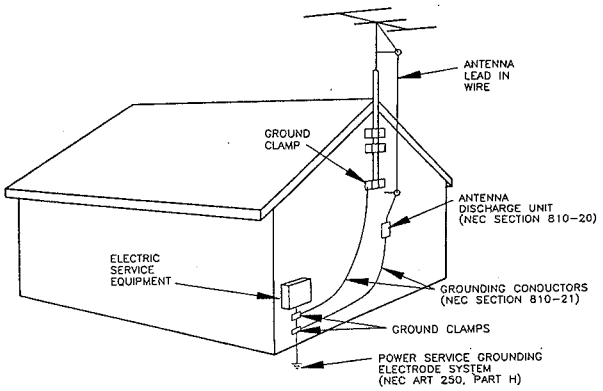
- **Read all of these instructions.**
- **Save these instructions for later use.**
- **Follow all warnings and instructions marked on the audio equipment.**

1. **Read Instructions** – All the safety and operating instructions should be read before the appliance is operated.
2. **Retain Instructions** – The safety and operating instructions should be retained for future reference.
3. **Heed Warnings** – All warnings on the appliance and in the operating instructions should be adhered to.
4. **Follow Instructions** – All operating and use instructions should be followed.
5. **Water and Moisture** – The appliance should not be used near water – for example, near a bathtub, washbowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool, etc.
6. **Carts and Stands** – The appliance should be used only with a cart or stand that is recommended by the manufacturer.

6A. An appliance and cart combination should be moved with care. Quick stops, excessive force, and uneven surfaces may cause the appliance and cart combination to overturn.

7. **Wall or Ceiling Mounting** – The appliance should be mounted to a wall or ceiling only as recommended by the manufacturer.
8. **Ventilation** – The appliance should be situated so that its location or position does not interfere with its proper ventilation. For example, the appliance should not be situated on a bed, sofa, rug, or similar surface that may block the ventilation openings; or, placed in a built-in installation, such as a bookcase or cabinet that may impede the flow of air through the ventilation openings.
9. **Heat** – The appliance should be situated away from heat sources such as radiators, heat registers, stoves, or other appliances (including amplifiers) that produce heat.
10. **Power Sources** – The appliance should be connected to a power supply only of the type described in the operating instructions or as marked on the appliance.
11. **Grounding or Polarization** – The precautions that should be taken so that the grounding or polarization means of an appliance is not defeated.
12. **Power-Cord Protection** – Power-supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plugs, convenience receptacles, and the point where they exit from the appliance.
13. **Cleaning** – The appliance should be cleaned only as recommended by the manufacturer.
14. **Power Lines** – An outdoor antenna should be located away from power lines.
15. **Outdoor Antenna Grounding** – If an outside antenna is connected to the receiver, be sure the antenna system is grounded so as to provide some protection against voltage surges and built up static charges. Section 810 of the National Electrical Code, ANSI/NFPA No. 70 – 1984, provides information with respect to proper grounding of the mast and supporting structure, grounding of the lead-in wire to an antenna discharge unit, size of grounding conductors, location of antenna-discharge unit, connection to grounding electrodes, and requirements for the grounding electrode. See Figure below.

EXAMPLE OF ANTENNA GROUNDING AS PER NATIONAL ELECTRICAL CODE


ANTENNA LEAD IN WIRE
GROUND CLAMP
ANTENNA DISCHARGE UNIT (NEC SECTION 810-20)
ELECTRIC SERVICE EQUIPMENT
GROUNDING CONDUCTORS (NEC SECTION 810-21)
GROUND CLAMPS
POWER SERVICE GROUNDING ELECTRODE SYSTEM (NEC ART 250, PART H)

NEC – NATIONAL ELECTRICAL CODE

16. **Nonuse Periods** – The power cord of the appliance should be unplugged from the outlet when left unused for a long period of time.
17. **Object and Liquid Entry** – Care should be taken so that objects do not fall and liquids are not spilled into the enclosure through openings.
18. **Damage Requiring Service** – The appliance should be serviced by qualified service personnel when:
    A. The power-supply cord or the plug has been damaged; or
    B. Objects have fallen, or liquid has been spilled into the appliance; or
    C. The appliance has been exposed to rain; or
    D. The appliance does not appear to operate normally or exhibits a marked change in performance; or
    E. The appliance has been dropped, or the enclosure damaged.
19. **Servicing** – The user should not attempt to service the appliance beyond that described in the operating instructions. All other servicing should be referred to qualified service personnel.

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SECTION 1 GENERAL DESCRIPTION

1–1. INTRODUCTION

The BR-20 Series are highly flexible and reliable professional stereo audio recorder/reproducers that use 1/4-inch wide tape on 5, 7 and 10-1/2-inch reels, at two selectable speeds : 15 inch/s (38 cm/s) and 7.5 inch/s (19 cm/s). All models are switchable between NAB and IEC equalization.

Basically, the BR-20 is available in three versions. The first is NAB standard, the second is DIN standard, and the third is a time code channel version. The table below shows further differences between them.

Features of the BR-20 include :

- Parallel I/O port for connection to SMPTE/EBU based synchronizers/controllers such as the TASCAM ES-50/ES-51
- Balanced +4 dBm inputs/outputs for professional connections
- Remote transport start and stop via the fader control of a suitably equipped mixer
- Easy access dip-switches change some functions to suit your preference (see "Optional Modifications", page 12)
- 3-point memory, entered either "on the fly" or via SELECT and NUMBER features
- Repeat playback over the desired segment of the tape
- 5-point autolocator : Return-to-zero, Locate to three MEMO points, and Direct Locate
- Search operations followed by Auto Play
- Variety of Edit modes
- Cueing at 2 selectable speeds
- Spool mode for uniform tape pack
- Maximum +/–12% speed variation both in record and playback
- Output/meter source selector switch for each channel
- Memory back-up system (see below, 1–2)

To get the most out of your BR-20, please take the time to read through this manual. Some time spent now will keep you from overlooking some of the features that make the BR-20 a more creative tool. You may discover some new tricks you haven't tried before.

Use of Capital Letters : In general, we use all upper case type to designate a particular switch, control or jack name or label (like PLAY). Some features are described with an upper case first letter (like Output Source Selector switch).

1–2. Memory Back-up Feature

The settings of the most major features of the BR-20 are retained in its back-up memory for about 3 days after the power is turned off, so the BR-20 is ready to continue to operate the moment you turn it on again. Specifically, the following are saved :

1. Tape Run Time Reading
2. TAPE SPEED (HIGH or LOW) and TAPE MODE (FIX or VARI)
3. MEMO 1–3 points
4. Last record or play start point (whichever operation was performed later than the other)
5. Positions of these features :
   - REEL SIZE
   - AUTO PLAY
   - REPEAT
   - Output Source Selector Switches
   - Track REC Enable Switches

BR-20 Version

Version	Destination Country	Gapless Punch-in/Spot Erase	Local Monitor Speaker	Reference Level (nWb/m)
NAB Standard	USA/CANADA	No	Yes	250/320
	Other Countries	Yes	No*	320/514
DIN Standard	Europe/U.K. only	Yes	No*	320/514
Time Code Channel model	USA/CANADA	Yes	No*	250/320
	Other Countries	Yes	No*	320/514

*) Optionally mountable

SECTION 2 SPECIFICATIONS

2–1. SPECIFICATIONS

MECHANICAL

Tape : 1/4 inch, 1.5 mil, low noise/high output, such as AMPEX #456
Track Format :
NAB model : 2-track. 2-channel (NAB 0.079 inch, 2.0 mm)
DIN model : 2-track, 2-channel (DIN 0.106 inch, 2.7 mm)
TC model : 2 audio tracks plus IEC standard center track for time code (audio 0.079 inch, 2.0 mm ; time code 0.015 inch, 0.38 mm)
Max. Reel Size : 10.5 inch (NAB hub), 11.1 inch (pancake)
Tape Speed : Switchable two speeds : 15 ips (38.1 cm/s) and 7.5 ips (19.05 cm/s)
Tape Speed Accuracy : Within +/1%
Pitch Control Range : +/–12%
Wow and Flutter :
15 ips : +/–0.06% peak, weighted (DIN 45507)
7.5 ips : +/–0.09% peak, weighted (DIN 45507)
Fast Wind Time : 120 seconds, maximum (for 2400-foot tape)
Spool Time : 370 seconds, maximum (for 2400-foot tape)
Start Time : less than 0.3 second
Capstan Motor : FG DC servo motor, belt drive
Reel Motor : DC motor x2
Head Configuration : 3 heads for erase, sync/rec, and reproduce
("TC" model only : time code track on erase and sync/rec heads)
External Dimensions (WxHxD) : 19" x 17-1/2" x 7-1/16" (483 mm x 444 mm x 180 mm)
Weight : 61-12/16 lbs. (28 kg)

ELECTRICAL

Input :	**Balanced**	**Unbalanced**
Impedance :	10k ohms	50k ohms
Maximum Source Impedance :	600 ohms	3k ohms
Nominal Input Level :	+4 dBm (in CAL)	–10 dBV (in CAL)

Output :	**Balanced**	**Unbalanced**
Impedance :	100 ohms	600 ohms
Minimum Load Impedance :	600 ohms	4k ohms
Nominal Load Impedance :	10k ohms	50k ohms
Nominal Output Level :	+4 dBm (in CAL)	–10 dBV (in CAL)

Headphone Output : 150 mW, maximum (8 ohm load)
Bias Frequency : 145 kHz (+/–3 kHz)
Equalization : NAB or IEC, switchable
In NAB ; 15 ips : 3180 +50 µs
7.5 ips : 3180 +50 µs
In IEC ; 15 ips : ∞ +35 µs
7.5 ips : ∞ +70 µs
Record Level Calibration :
USA/CANADA : 250 nWb/m at LOW
320 nWb/m at HIGH
Other models : 320 nWb/m at LOW
514 nWb/m at HIGH
Monitor Speaker : 150 mW, maximum (CH1, MIX, CH2, switchable)
(Optional except for NAB standard USA/Canada model)
Frequency Response for Record/Reproduce (LOW REF LEVEL) :
15 ips : 35 Hz to 22 kHz (+/–2 dB) at 0 VU
30 Hz to 22 kHz (+/–2 dB) at 0 VU (Time Code channel model)
7.5 ips : 30 Hz to 20 kHz (+/–2 dB) at –10 VU

Signal-To-Noise Ratio (Referenced to 3% THD, in CAL)
DIN AUDIO filter/NAB A weighted

Reproduce

15 ips :	NAB/TC models :	at NAB, 72 dB/79 dB
		at IEC, 74 dB/81 dB
	DIN model :	at NAB, 73 dB/80 dB
		at IEC, 75 dB/82 dB
7.5 ips :	NAB/TC models :	at NAB, 73 dB/80 dB
		at IEC, 70 dB/77 dB
	DIN model :	at NAB, 74 dB/81 dB
		at IEC, 71 dB/78 dB

Record/Reproduce

15 ips :	NAB/TC models :	at NAB, 66 dB/71 dB
		at IEC, 67 dB/72 dB
	DIN model :	at NAB, 67 dB/72 dB
		at IEC, 68 dB/73 dB
7.5 ips :	NAB/TC models :	at NAB, 67 dB/72 dB
		at IEC, 64 dB/69 dB
	DIN model :	at NAB, 68 dB/73 dB
		at IEC, 65 dB/70 dB

Distortion : 0.8 % or less, at 1 kHz, 250 or 320 nWb/m
3 % at 1 kHz, 1040 nWb/m, 15 ips

Channel Crosstalk : 60 dB or more (NAB/TC models)
55 dB or more (DIN model)

Erasure : 70 dB or more, at 1 kHz, 790 nWb/m

Power Consumption : 95 Watts

TIME CODE CHANNEL (BR-20T model only)

Input (Balanced)
Impedance : 10k ohms
Maximum Source Impedance : 600 ohms
Nominal Input Level : 2 Vp-p
Minimum Input Level : 0.3 Vp-p
Maximum Input Level : 20 Vp-p

Output (Balanced)
Impedance : 100 ohms
Minimum Load Impedance : 600 ohms
Nominal Load Impedance : 10k ohms
Output Level : 2 Vp-p

Record Level : 707 p-p nWb/m

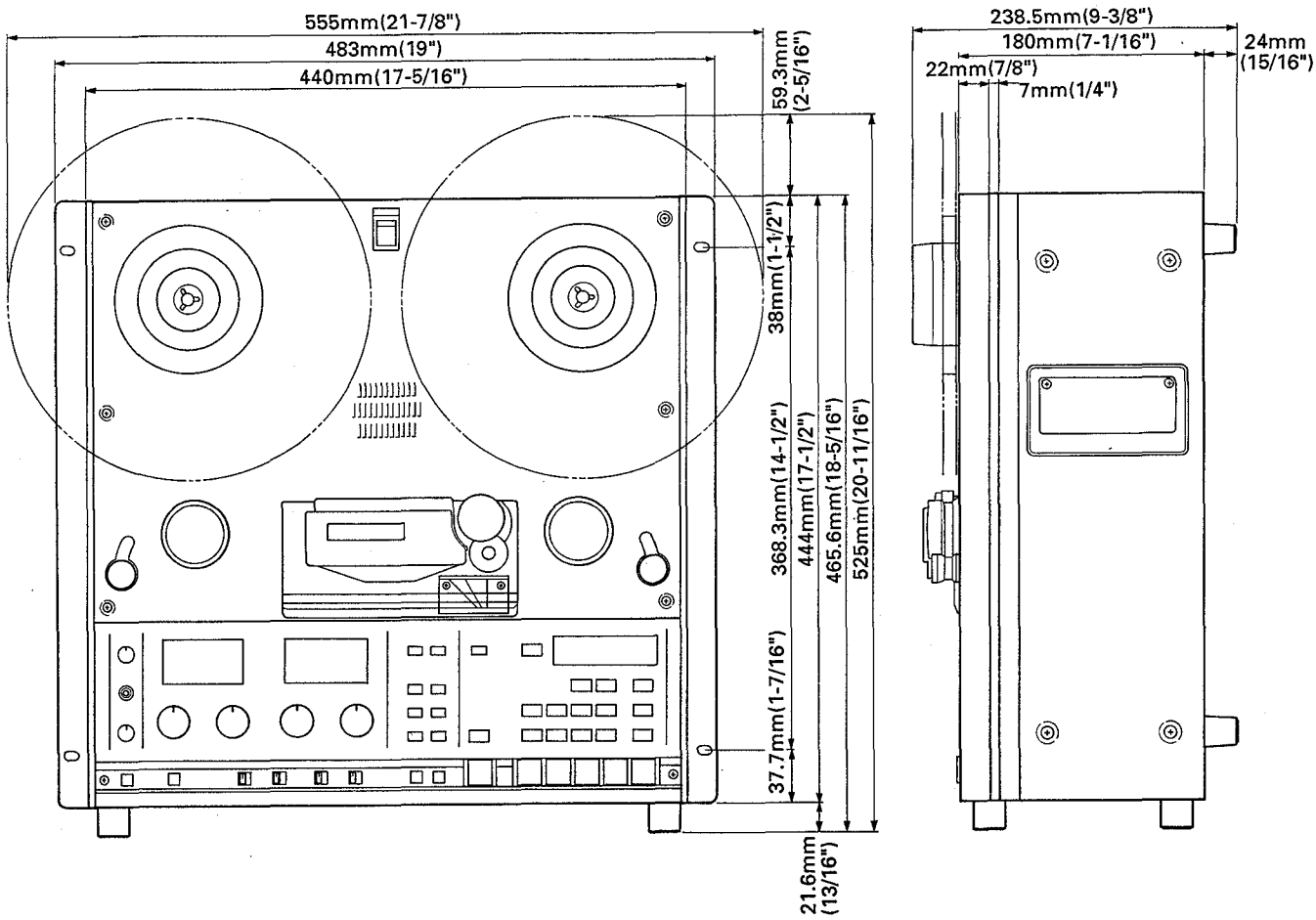
Crosstalk (to Audio tracks) : 80 dB or more

OPTIONS

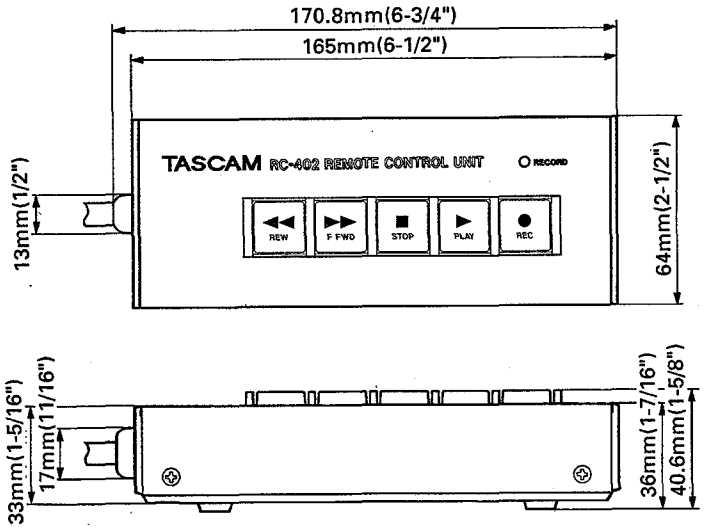
- RC-402 Transport Remote
- MA-20 Mic Amplifiers
- SP-20 Local Monitor Speaker (premounted in NAB standard USA/Canada model)

See also the "Optional Modifications" and the "Optional Accessories" section of this manual.

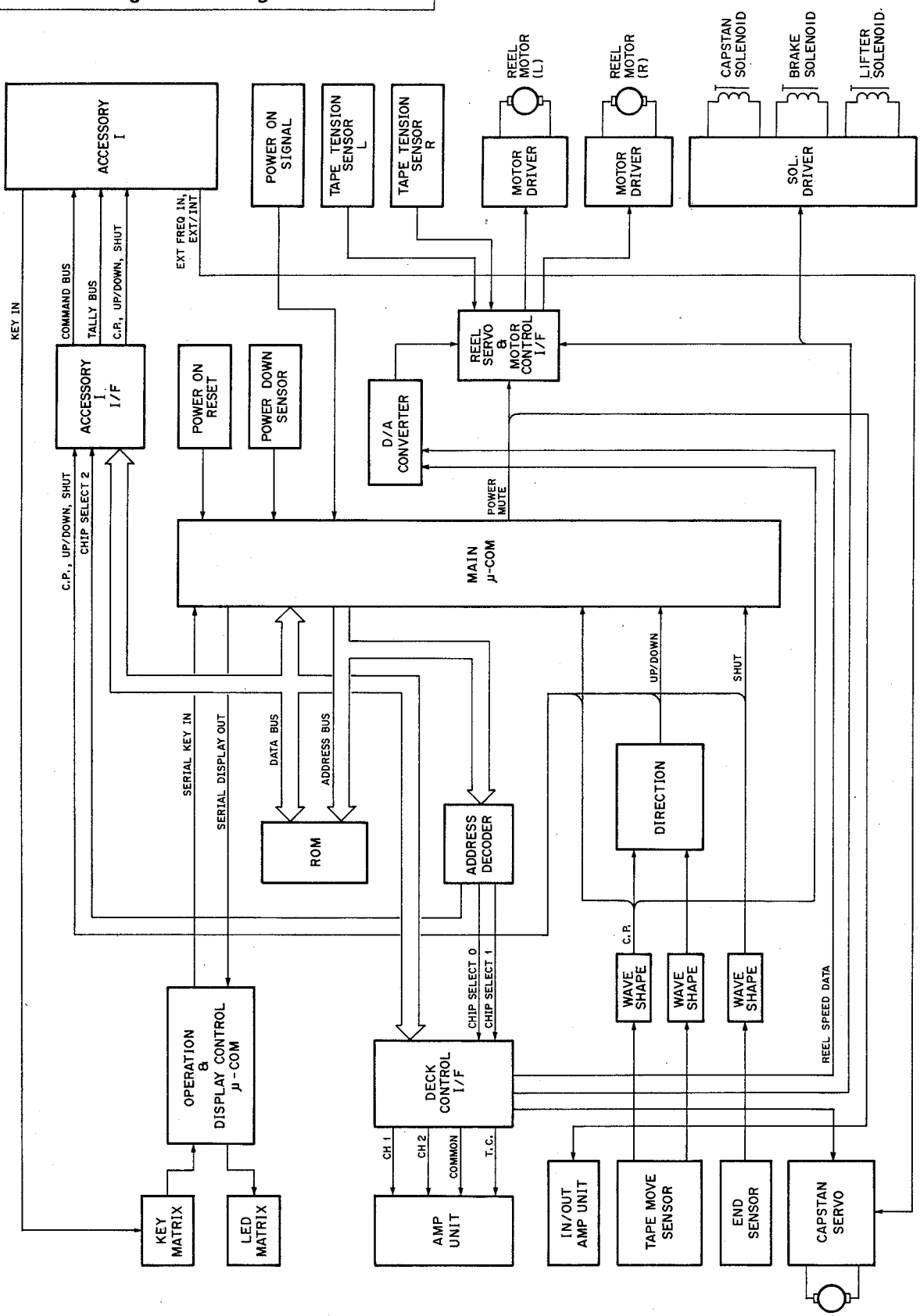
BR-20 External Dimensions



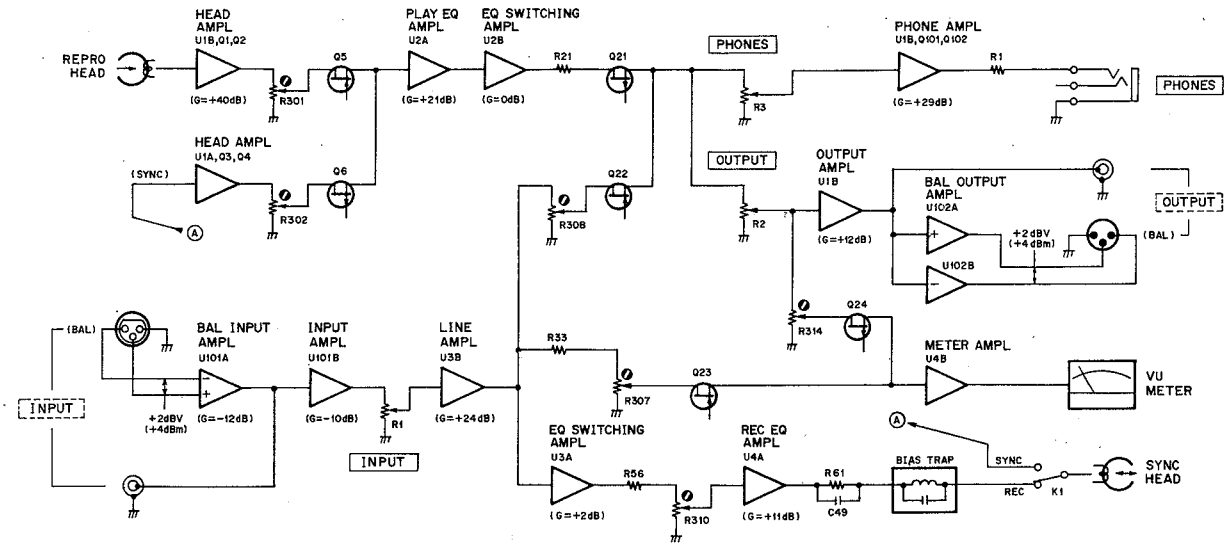
RC-402 (Optional) External Dimensions

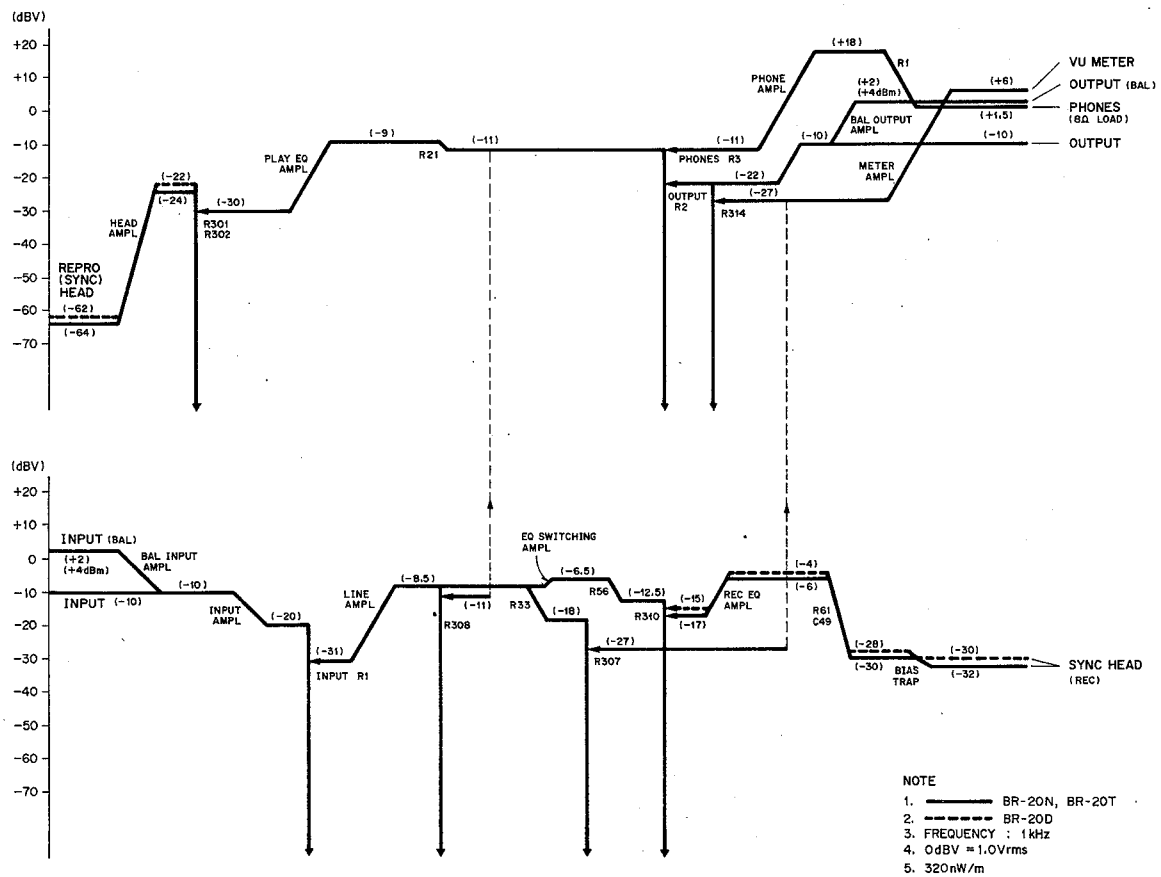


2–2. Control Signal Block Diagram



2-3. Audio Signal Block and Level Diagrams





NOTE

1. ——— BR-20N, BR-20T
2. - - - - - - BR-20D
3. FREQUENCY : 1kHz
4. 0dBV = 1.0Vrms
5. 320nW/m

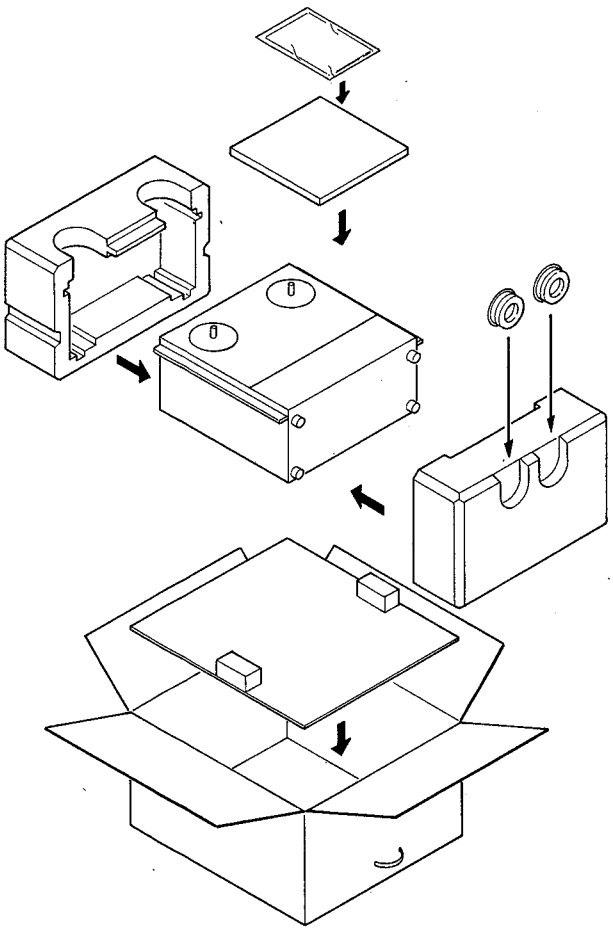
SECTION 3 INSTALLATION

3–1. UNPACKING AND INSPECTION

During unpacking, be careful not to damage the BR-20. Save the carton and packing material. You may need them to transport your BR-20 sometime in the future.

In addition to the BR-20 recorder/reproducer, the package should contain the following :

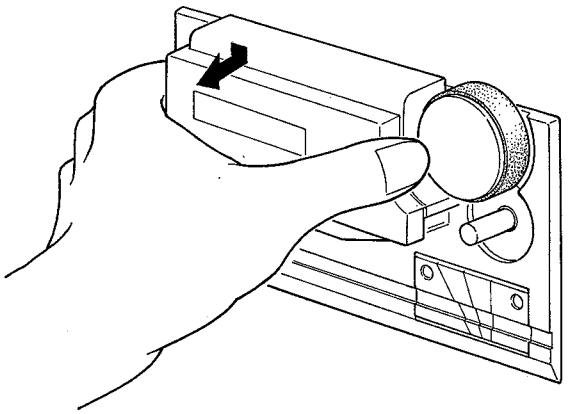
Reel adapter (TZ-614) x2
10.5 inch reel x1
Feet mount screw (pan head) x4
Rack mount screw (oval countersunk head), w/washer and spacer x8
Operation/maintenance manual x1
Warranty card x1



After unpacking, check the units for any evidence of damage due to rough handling during transport. Contact your dealer if you have any questions.

• HOW TO REMOVE THE HEAD ACCESS COVER

Gently press the left side of the cover to the right and lift the left side up slightly. Then pull and lift to the left to release fully. When replacing the cover, first insert the tab into the slot on the right side of the head assembly, then gently press the left side in to lock it into position. DON'T FORCE IT. Carefully handle both in removing and replacing.



NOTE FOR U.K. CUSTOMERS

Due to the variety of plugs being used in the U.K., this unit is sold without an AC plug. Please request your dealer to install the correct plug to match the mains power outlet where your unit will be used as per these instructions.

IMPORTANT

The wires in this mains lead are coloured in accordance with the following code:

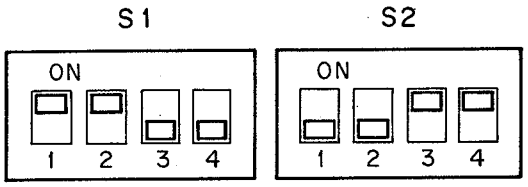
BLUE: **NEUTRAL**
BROWN: **LIVE**

As the colours of the wires in the mains lead of this apparatus may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows;

The wire which is coloured BLUE must be connected to the terminal which is marked with the letter N or coloured BLACK. The wire which is coloured BROWN must be connected to the terminal which is marked with the letter L or coloured RED.

3-2. OPTIONAL MODIFICATIONS

There are two DIP-switches on the Control PC Board inside the BR-20. Their default settings and functions are as follows :



Switchers S2-3 and -4 are not used.

S1-1 : ON (Memory Back-up feature is active)
S1-2 : ON (Fader Stop function is available)

- Fader Start function can also be switched on/off. As for the procedure, see the "Features and Controls" section of this manual, item 43.

The next S1-3 switch has no effect on the NAB standard U.S.A/Canada model.

S1-3 : OFF (Gapless punch-in and spot erase are active)

Note : S1-3 is a "defeat" switch and "OFF" means the function is NOT defeated.

S1-4 : OFF (Tape speed is switchable between 7.5 inch/s (19 cm/s) and 15 inch/s (38 cm/s)

- ON position is for 3-3/4 and 7-1/2 inch/s (9.5 and 19 cm/s) tape speeds. This entails installation of some internal parts. Consult TASCAM or your nearest TASCAM dealer.

S2-1 : OFF (On-the-fly tape point capture and its storage into memory are done at once by hitting a MEMO key alone.)

- With this switch set to ON, MEMO only captures the current tape point, and, when NUMBER is subsequently pressed, that point is actually memorized.

S2-2 : OFF (Monitor source : INPUT, SYNC, and REPRO, can be selected for the separate channels)

- With this switch set to ON, both channels' monitor sources are selected at once by either channel's selector switch.

Information on how to get access to the DIP switches is found in the "Maintenance" section of this manual.

The following options and modifications are also available :

1. Installation of mic amplifiers (MA-20)

   Additional features of the optional MA-20 are described in the "Features and Controls" section of this manual.

2. Installation of a local monitor speaker (SP-20)

   The SP-20 is premounted in the NAB standard USA/Canada models.

3. Changing the basic transport control key layout to suit your preference sequence

The above options and modifications can not be installed or performed by the end user. Consult TASCAM or your nearest TASCAM dealer.

VOLTAGE CONVERSION (General Export Models Only)

NOTE : Voltage conversion is not possible on models sold in the U.S.A., Canada, U.K., Australia or Europe.

For general export models only, if the input voltage specified on the machine, power cord tag, or packing carton differs from the line voltage at the installation site, please request your dealer to change the voltage setting of the machine. The procedure entails the opening of the machine.

3-3. INSTALLATION SITE

The BR-20 may be used in most areas, but to maintain top performance and prolong operating life, observe the following environmental limitations :

1) Nominal temperature should be 5 to 35 degrees Centigrade (41 to 95 degrees Fahrenheit).

2) Relative humidity should be 30 to 90% (non-condensing).

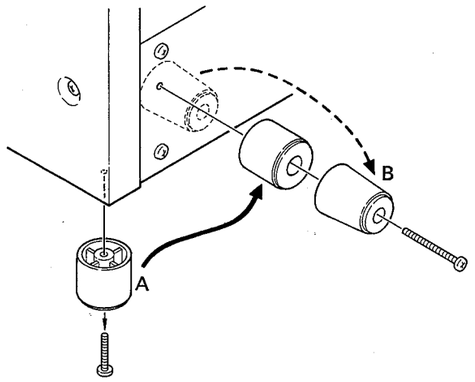
3) Strong magnetic fields should not exist nearby.

3–4. Rack Mounting the BR-20

The BR-20 may be mounted to a standard EIA 19" rack, such as the TASCAM CS-608 or CS-607B. Before mounting, make sure the rack you are mounting the BR-20 to is not warped or bent. Screwing to a badly warped surface may cause misalignment of the transport.

- BR-20 in horizontal position

  When the BR-20 is operated on its back in a horizontal position, remove the "A" and "B" feet (each four), attach the "A" feet to the back, then attach the "B" feet to the "A" feet, as shown. This allows sufficient space at the back of the machine for the protruding XLR type connectors.



3–5. INITIAL CONNECTIONS

CAUTION : To prevent problems, before attempting any cable connection check to make sure all units involved in your system are turned off.

When connecting the BR-20 to your system, use shielded cables that are as short as your situation will allow. We recommend low-capacitance cables with quality connectors, such as the TASCAM Pro Series. Cheaper cable has less shielding and may introduce radio frequency interference, hum and noise into your system.

A. Input/Output Connections

The BR-20's line inputs and outputs are handled both by XLR type connectors (+4 dBm standard) and RCA jacks (–10 dBV standard) located on the rear connector panel of the machine.

The stereo buss output of your mixer may be connected to the CH1 and CH2 INPUTs of the BR-20. The OUTPUTs of the machine may be sent back to the monitor section of the mixer, or directly to your amplifier/monitor system, depending on the application.

- When the optional MA-20 Mic Input Amplifires are mounted...

  Connect mic signals to the MIC inputs. When the front panel's MIC/LINE selector switch is set for MIC inputs, the ATT switch located beside each MIC input connector can be set for 20 dB attenuation of MIC signals to prevent to distort the mic amplifiers.

B. "ACCESSORY 1" Connection

On the BR-20's rear panel is located an ACCESSORY 1 connector that is a parallel port, meaning transport controls are each brought to a separate pin of the connector for external connection to the TASCAM ES-50 or other SMPTE/EBU synchronizers.

Alternatively, the ACCESSORY 1 connector is used for connection to the optional transport remote control unit, or to fader switches so the transport start and stop are controlled from the fader of a mixer. Pin 25 of the connector is assigned for the fader start/stop (see chart on the right).

- Synchronizer Interface

Connection between the ES-50 Synchronizer/ES-51 Edit Controller and the BR-20 is a plug-and-go proposition. Pre- wired interface cables needed are available from TASCAM.

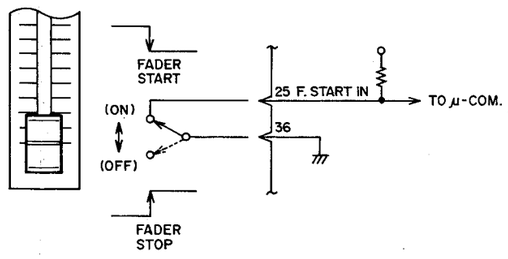
The BR-20 provides signals to the synchronizer which indicate its speed, the direction of the tape travel, and a reference power supply. Also, tally signals indicating the BR-20's mode (PLAY, F.FWD, REW, STOP) are given to the synchronizer so it knows the current transport status. Inputs on the same ACCESSORY 1 connector are provided for status commands from the synchronizer (PLAY, F.FWD, REW, STOP, REC, LIFTER CONT). Also, there is an input for a capstan drive reference frequency signal from the synchronizer so that the actual record/play speed can be varied to maintain synchronization.

NOTE : Take the appropriate measure to prevent a ground loop from occurring through the ACCESSORY 1 connector. If you have questions, consult a person familiar with studio grounding techniques.

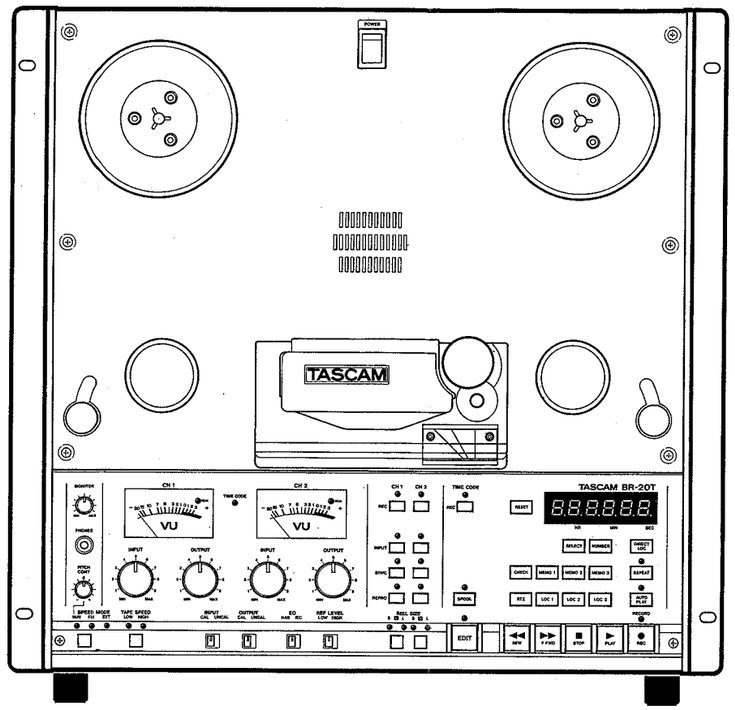
The BR-20 will operate satisfactorily with a variety of other manufacturers' synchronizer/controllers. The manual for these products should provide you with enough interface information for use with the TASCAM tape machines. Or else, consult the synchronizer manufacturer for further details on interface.

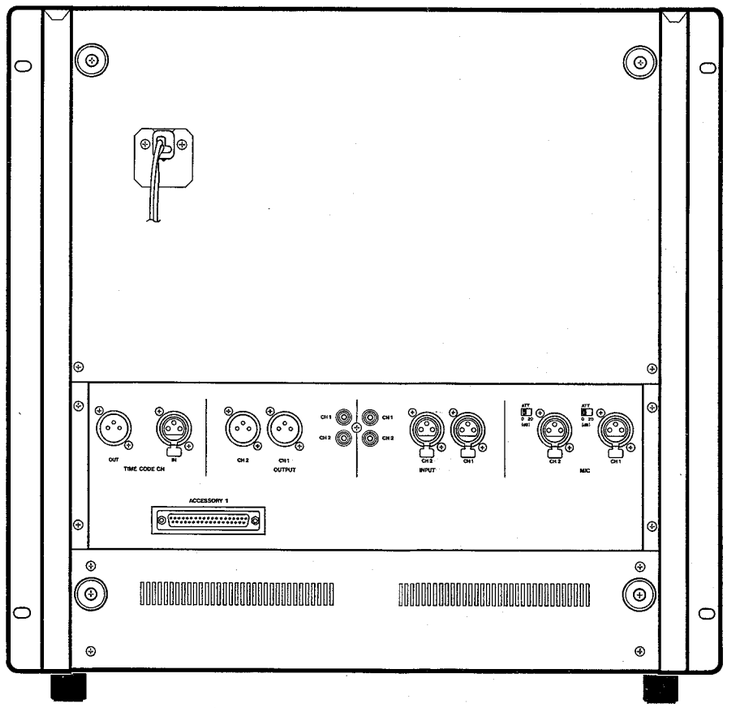
ACCESSORY 1 Pin Assignment Chart

Pin #	IN(put) – OUT(put) signals		Function
1	$\overline{\text{PLAY}}$	IN	Inputs PLAY signal at L level.
2	$\overline{\text{FF}}$	IN	Inputs FF signal at L level.
3	$\overline{\text{REW}}$	IN	Inputs REW signal at L level.
4	open terminal		
5	$\overline{\text{STOP}}$	IN	Inputs STOP signal at L level.
6	$\overline{\text{REC}}$	IN	Inputs REC signal at L level.
7	$\overline{\text{LIFTER CONT}}$	IN	Inputs LIFTER shift cancellation signal at L level.
8	open terminal		
9	UP/$\overline{\text{DOWN}}$	OUT	Outputs tape running control signal at H or L level.
10	CP	OUT	Outputs open-collector signal (12 Hz pulse at 15 ips.)
11	$\overline{\text{PLAY}}$ TALLY	OUT	Outputs open-collector signal (Low level during PLAY mode.)
12	$\overline{\text{FF}}$ TALLY	OUT	Outputs open-collector signal (Low level during REW mode.)
13	$\overline{\text{REW}}$ TALLY	OUT	Outputs open-collector signal (Low level during REW mode.)
14	$\overline{\text{STOP}}$ TALLY	OUT	Outputs open-collector signal (Low level during STOP mode.)
15	$\overline{\text{REC}}$ TALLY	OUT	Outputs open-collector signal (Low level during record mode.)
16	$\overline{\text{SHUT-OFF}}$ TALLY	OUT	Outputs open-collector signal (Low level during tape stop)
17	open terminal		
18	open terminal		
19	$\overline{\text{REW}}$ COMMAND	OUT	Outputs open-collector signal (Low level when REW is pressed)
20	$\overline{\text{FF}}$ COMMAND	OUT	Outputs open-collector signal (Low level when F. FWD is pressed)
21	$\overline{\text{PLAY}}$ COMMAND	OUT	Outputs open-collector signal (Low level when PLAY is pressed
22	$\overline{\text{STOP}}$ COMMAND	OUT	Outputs open-collector signal (Low level when STOP is pressed)
23	$\overline{\text{REC}}$ COMMAND	OUT	Outputs open-collector signal (Low level when REC is pressed)
24	open terminal		
25	F. $\overline{\text{START}}$	IN	Transport start from fader switches, active at Low level. (See also diagram below.)
26	↕		
27	↕		
28	open terminal		
29	↕		
30	↕		
31	EXT FREQ.	IN (HOT)	Inputs speed control signal at input signal of 3.0 V or more and of 9.6 kHz, –40 to +30 % (HOT side)
32	EXT FREQ.	IN (COLD)	Inputs speed control signal (COLD side)
33	INT/$\overline{\text{EXT}}$	IN	Inputs internal/external speed control select signal. Internal: HIGH level External: LOW level
34	open terminal		
35	+15 V supply voltage	OUT	Maximum: 50 mA
36	Main unit GND		
37	+5 V supply voltage	OUT	Maximum: 50 mA



The BR-20 responds to the fader start command only when it is in STOP and responds to the fader stop command only when it is in PLAY : the transport toggles STOP and PLAY.





SECTION 4 OPERATION

4–1. PRE-OPERATING PROCEDURES

4–2. Reel Installation

The BR-20 accepts 5 or 7 inch (12 or 17 cm) reels with small hubs (EIA standard) and 10.5 inch (26 cm) reels with large hubs (NAB standard). Thanks to the separate REEL SIZE selector switches for both the supply and takeup sides, it is not absolutely necessary to mount the same size of reels on both sides.

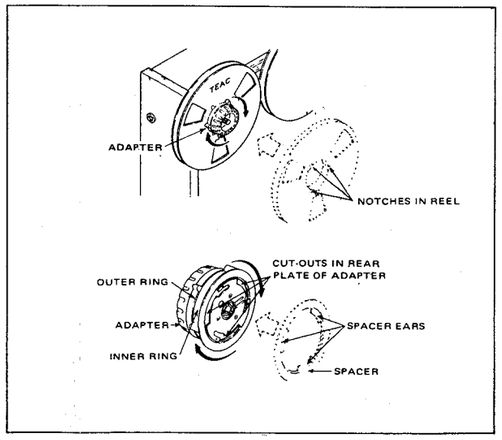
• Small Hub Reels :

When using 5 or 7 inch reels with small hubs, proceed as follows :

1. Line up the three slots in the center hole of the reel with the three holding keys in the inner section of the reel-table spindle and push the reel against the reel table.
2. Pulling the spindle up, rotate it in either direction about 60 degrees, then release your hand. The reel will lock in place.

   Reverse the procedure to remove the reel.

• Large Hub Reels :



A metal spacer is mounted on the back of the provided reel adaptors (TZ-614), and must be in place as shown above when installing 10.5 inch metal reels. When installing plastic reels, remove the spacer by turning it counterclockwise.

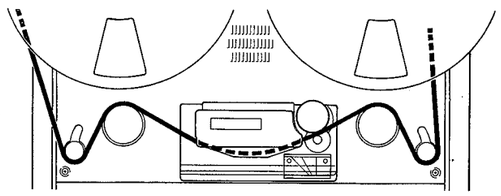
To install 10.5 inch reels with large hubs, proceed as follows :

1. Turn the reel adaptor knob fully counterclockwise.
2. Line up one of the three slots in the reel hub with the locating pin on the reel table.
3. Push the reel against the reel table until it is seated.
4. Turn the reel adaptor fully clockwise.
5. Before running tape, make sure that the reels are firmly secured to the reel adaptors and the adaptors are firmly secured to the reel spindles.

4–3. Tape Threading

1. If you didn't yet, place a full reel of tape on the supply (left) reel table and an empty reel on the takeup (right) reel table. Secure both reels as explained above, 4–2.
2. Refer to illustration below and thread the tape exactly as shown.
3. Rotate the takeup reel until there is no slack in the tape.

   Before running tape, check to see both reels are firmly locked in place.



4–4. OPERATING PROCEDURES

CAUTION

Keep your fingers away from a running tape edge. Don't operate the POWER switch when tape is moving; first press STOP to stop the tape.

4–5. Recording

1. Check to see all the connections have been made correctly.
2. Turn the power on.
3. Load a blank tape as per instructions under paragraph 4–3.
4. Set the REEL SIZE selector switches both to SMALL or LARGE, or one to SMALL and the other to LARGE, depending on the reels in use.
5. Set the TAPE SPEED switch to HIGH for the best quality recording.
6. Set the SPEED MODE switch to FIX.
7. Check to see the EDIT LED is off. If not, turn it off by pressing the key.
8. Set the EQualization switch to match NAB or IEC equalization curve, as necessary.
   - On MIC input model, the EQ selection is made by a DIP switch on the MIC AMP PC Board. The default setting is NAB or IEC as ordered.
9. Set the REF LEVEL switch to appropriate position for kind of tapes being used.
   - On MIC input model, the REF LEVEL is selected by a DIP switch on the MIC AMP PC Board. The default setting depends on the resquest.
10. (MIC input model only) — Set the CH 1 and CH 2 MIC/LINE selector switches to match the input sources.
11. Set the CH 1/CH 2 INPUT level controls to the nominal "7" position.
12. Set the CH 1/CH 2 OUTPUT level controls to the nominal "7" position.
13. Place the INPUT CAL/UNCAL switch in the right/UNCAL position.
14. Press the RESET key, so you can use RTZ (Return-To-Zero) to get back to this point.

Setting the Record Level

15. Set the Output Source Selector switch of both channels to INPUT so you can monitor input signal by the VU meters before starting tape.
16. To hear input signal, properly set the monitor section of your mixer; or, plug in headphones to the PHONES jack.
    - NAB standard U.S.A/Canada model — Keep the PHONES jack empty if you want to use the internal local monitor speaker.
17. Play your multitrack, and watch the meter on the mixer and the VU meters on the BR-20. At the loudest point, both meters should peak at the reference level of "0". If not, adjust the stereo master fader on the mixer and the INPUT level controls on the BR-20. (Check to make sure the INPUT CAL/UNCAL switch is set to UNCAL position.)
18. (On MIC input model only) — Speak into the mic, at levels that are expected during the performance and adjust the INPUT level controls for "0 VU" reading.
19. When the record level has been properly set, rewind the multitrack.
20. Press the SYNC switch of both channels, so the meters show signals read off the tape until recording starts. Once recording started, the meters will automatically switch to show input signals.
21. Press both CH 1/CH 2 REC Enable switches for two-channel recording. A red LED will start blinking above the switches, indicating "Record Ready" mode.
22. To initiate recording, press both the master REC and the PLAY key. The tracks' REC LEDs will turn on solid.
23. When recording is complete, press STOP.
24. Press the REC Enable switches again. Their blinking LEDs will go out showing the tracks are now in "Safe".

Review

25. Press the RTZ key. The tape will rewind, automatically stopping at counter zero point. (You could also press DIRECT LOC instead of RTZ.)
    - Optional : You can press AUTO PLAY before or after RTZ. Then, the tape will automatically start playing when the counter zero point is reached.
26. If AUTO PLAY is not active and the tape stops, press PLAY.

4–6. Punch-in or Insert Recording

GAPLESS PUNCH-IN/OUT

- NAB standard U.S.A./Canada models do not have the gapless punch-in function.

Although the advanced circuitry of the BR-20 allows gapless punch-in on the tape, there is still the distance between the erase and record heads to be compensated for. Depending on tape speed, the time from a punch in to the actual in/out is 1/15th or 1/8th of a second. A few practice runs will get you accustomed to the timing of punching in.

The BR-20 offers two ways to initiate the punch-in :

Method 1. Punching with the Master REC Key

1. Press the REC Enable switch of the track you intend to punch in. Its LED will start blinking.
2. Press PLAY. If the track's Output Source Selector switch is at SYNC, you will hear the tape. Set the switch to INPUT to hear the input signal.

   Adjust the input and output (monitor) levels for the desired balance.

   - When the level balance is achieved, be sure to set the Output Source Selector switch to SYNC.
3. When the tape reaches the desired punch-in point, press the master REC key ("master" opposed to "track") to start recording. The monitor will switch from tape to input on that track (provided that the Output Source Selector switch is at SYNC). Both the master and track REC LEDs should now be on solid.
4. Punch out by pressing STOP or PLAY.

Method 2. Punching with the Track REC Switch

1. After the recording and monitoring levels are set, make sure that both tracks are SAFE (no track LED blinking).
2. Press the master REC key together with PLAY to start playing the tape. Both the master and track REC LEDs will blink, showing the machine is in Record Ready mode.
3. Press the punch-in track's REC switch when the tape reaches the punch-in point. Both the master and track REC LEDs will light up steadily, showing recording is taking place.
4. To punch out, press the track REC switch again (you could also press STOP or PLAY).

4–7. Playback of Pre-recorded Tapes

1. Load a pre-recorded tape as per instructions under paragraph 4-3.
2. Set the REEL SIZE selector switches to match the size of reel in use.
3. Set the TAPE SPEED switch to match the speed at which the tape was originally recorded.
4. Check to see the EDIT LED is off.
5. Set the EQ and the REF LEVEL switch to the positions used for recording the tape.
6. Press PLAY to begin playback.
7. To stop the tape, press STOP

4–8. Built-in Autolocators

The BR-20 has three tape location memories : MEMO 1–3.

1) "On the fly" entry

Simply hit one of the three MEMO keys at the desired moment. The counter display at that moment is retained in the machine's memory system.

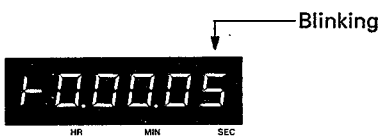
- You can modify the MEMO circuitry so the MEMO point is stored into memory only when the NUMBER key is pressed after MEMO. See the "Optional Modifications" section of this manual.

2) Using SELECT and NUMBER

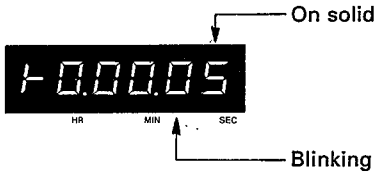
Proceed as follows :

1. Press the SELECT key. The digital counter will switch to MEMO point setting/storage mode. The display will look like this :

2. Press the NUMBER key until the desired numeral appears.



3. Press the SELECT key again. The blinking "0" will reappear but in the SEC 10th digit window this time. Press NUMBER until the desired numeral appears.



In a similar way, enter the desired whole number.

4. When the desired location time is fully entered, press one of the three MEMO keys.

The counter will switch back to its normal time counter mode.

- To abort the MEMO point setting procedure before pressing a MEMO key (that is, before performing step 4 above) and quit SELECT mode, press any of the transport keys. Note that pressing CHECK is also the same effect.

- To locate the tape to a MEMO point, press the same numbered LOC key. If AUTO PLAY is active, the tape will automatically start playing after search operation.

3) Direct Locate

If you press the DIRECT LOC key after completion of step 3 above (that is, before pressing MEMO), the tape will be located to the point you've entered via SELECT/NUMBER, directly, without being loaded into memory.

4–9. Repeat Play

1. Use two of the three MEMOs to establish the beginning and the end point of loop (see above, 4–8).

2. Press REPEAT (in whatever the current transport mode is). Its LED will start blinking.

3. Press the desired two MEMO keys.

The tape will be located to the lower MEMO location while the counter display will show the beginning and the end point of your loop. The REPEAT LED that was blinking will go on solid if the current tape location is within the two MEMO points (the LED will continuously be blinking if the current tape location is out of the two MEMO points). As soon as that location is reached, the tape will automatically start playing to the higher MEMO location, rewind to the lower MEMO location and start over.

- To verify which MEMOs define the current loop, press CHECK (when the REPEAT LED is blinking or stay on solid). A broken line will appear in the counter display. Then, hold REPEAT. Two MEMO numbers (not MEMO contents) will be displayed. To go back to the normal counter mode, press CHECK again.

To stop REPEAT sequence :

- To definitely leave REPEAT mode, press REPEAT again. Its LED will turn off.

- To interrupt the sequence temporarily, press any transport keys (except for PLAY). The function pressed will be activated, and if you get past the beginning or end of your loop, the REPEAT LED will start blinking.
  To resume the REPEAT sequence, press the appropriate LOC key to locate the tape to the lower MEMO point, or, if you are now within the loop or behind the lower MEMO point, press PLAY.

- During REPEAT (whether a sequence is currently playing or not), the remaining third MEMO register is available for storing a new tape location, but the two MEMO registers in use for REPEAT are not.

- You can directly initiate record from REPEAT mode. But, the REPEAT function is continuously active (the REPEAT LED will continue to blink or stay on solid) until you press REPEAT.

4–10. Splice Editing

Preliminary Notes :

- When splicing tape, never use ordinary adhesive or pressure sensitive tape. Use only special tapes made for splicing (editing) recording tape. Splicing tape has a small amount of low-tack adhesive which is adequate to grip the backing of the recording tape, yet which will not "ooze" out beyond the splice after being wound under tension and shuttled over the heads. Conventional tape almost always "leaks" adhesive onto the heads and onto adjacent windings of tape on the reel.

- Always use non-magnetic tools, including razor blades, when splicing tape. Magnetized tools will cause a "click" upon playback.

The following is just one of the tape editing procedures that can be accomplished on the BR-20. For more possibilities that the EDIT feature provides, see the "Features and Controls" section of this manual, item #21.

1. To locate the section to be edited, press EDIT (while in STOP mode), then hold F.FWD or REW. The tape lifters will retract so the tape contacts the heads, allowing you to monitor the tape as it runs at F.FWD or RWD speed.

2. When the approximate point is cued out, release F.FWD or REW. The tape will stop.

3. Rotate the reels by hand in either direction until you hear the exact location on the tape.

4. When the exact point is cued out, open the head access cover and use a grease pencil ("china marker") to mark the cut point opposite the rec/sync head if the Output Source Selector switch is at SYNC, or the repro head if set to REPRO).

5. Pull the tape forward and lay it on the splicing block (oxide down) and cut the tape at the mark using a non-magnetic single-edged industrial razor blade.

6. If a substantial length of tape is to be removed, rethread the tape from the supply reel past the heads, capstan, and pinch roller... and let the end hang off the right side of the transport.

7. Holding down EDIT, press PLAY. The tape will unthread itself ("dumping") from the supply reel as you listen to it play.

8. When you cue out the last of the unwanted section of tape, press STOP.

9. Press EDIT again, and manually move the tape so the splice point is opposite the head being used for cueing, mark that point, and cut the tape at the mark.

10. Butt the two cut ends from the supply and takeup reels, apply a small piece of splicing tape, and trim the excess along both edges of the recording tape.

4–11. Time Code Track (BR-20T only)

The BR-20T is provided with the capability of recording and reading SMPTE/EBU time code (29.97 fps, 30 fps, 24 fps, and 25 fps) on an IEC standard 0.3 mm wide track centered on the rec/sync head. The same track spacing is also used on the erase head.

FSK sync tones can also correctly be recorded on the time code track. But, you can't use the track for recording normal audio signals.

The sequence in which time code and audio program are recorded will depend on the particular application, and may be as follows :

1. First record time code, then record audio program with the BR-20T synchronized to other time code based equipment, or inversely, first record audio then time code.

2. Record time code and audio simultaneously.

Preliminary Notes :

- Be sure the audio tracks are in "safe" with their LEDs off unless you intend to record them together with the time code track simultaneously.

- To avoid crosstalk between the center track and the audio tracks, be sure to record the audio material at the correct level.

Striping Time Code

A complete explanation of procedures will be found in the manual for your synchronizer but here are a few notes about recording and playing back SMPTE/EBU that you must know.

1. Take the time code generator output of your synchronizer and plug it into the TIME CODE CH "INPUT" of the BR-20T.

   The time code fed into the BR-20T is looped out from the TIME CODE CH OUTPUT, allowing you to record the code on another tape machine at the same time. To do so, connect the TIME CODE CH OUTPUT to the input jack of the appropriate channel of your second machine. The TIME CODE CH OUTPUT level is 2 V p-p (10.5 V).

2. Check to see the BR-20T's SPEED MODE is set to FIX.

3. Put the time code track into Record Ready by pressing its REC Enable switch. Its LED will start blinking.

4. Run the tape by pressing PLAY for about a minute of "leader".

5. Press the master REC key, and start the time code generator. The TIME CODE indicator will light up, indicating time code is being fed into the BR-20T.

   The acceptable range of time code is 0.3 to 20 V peak-to-peak (2 V p-p nominal).

6. After striping the entire length of the tape, rewind the tape to the beginning.

7. Release the track's REC Enable switch by pressing it. Its LED will turn off.

For playback of the time code track :

8. Connect the TIME CODE CH "OUTPUT" of the BR-20T to the appropriate time code input (either Master or Slave) of the synchronizer.

9. To make sure that the time code was recorded, press PLAY. The TIME CODE LED will turn on solid. The time code display on the synchronizer or reader should increment. To verify that the machine is getting time code (and not counting tach pulses), temporarily unplug the ACCESSORY 1 connection from the BR-20T. If the reader still is running, and it stops and starts as you stop and play the BR-20T, you have successfully recorded the time code track.

NOTE : Once the time code track is complete, disconnect the TIME CODE CH INPUT connection or turn off the time code generator. This will make the output of the audio tracks cleaner.

■ An Introduction to SMPTE Time Code

SMPTE is an acronym for the Society of Motion Picture and Television Engineers. The SMPTE Time Code was defined in 1970 (C98.12: time and control code for video and audio tape for 525/30 television system). This specification has now become accepted as a universal standard, although additional practices have been informally added over the years (i.e., drop frame), as explained below.

The 1970 SMPTE code is an 80-bit digital code which designates the exact location in hours, minutes, seconds, and frames. There are 24 frames/second in film time code, and 30 frames/second on television time code. Some of the bits in the time code are undefined "user bits," and are often used to identify takes or production sequences, or for special functions (opening and closing automated theatre curtains, for example).

Drop Frame Time Code

It used to be true that U.S. television operated at 30 frames/second, but that was in a monochrome ("black and white") world, and current NTSC (National Television Standards Committee) standards utilize 29.97 frames/second for color TV broadcast. This means that an hour of 30 frame/second code is about 3.6 seconds too long when run at 29.97 frames/second. In order to remedy the problem, a slightly different time code format known as "DROP FRAME" was developed. In drop frame, one frame is dropped (skipped) every 108 frames, except that every tenth minute the frames are not dropped. In some cases, the difference between drop frame and standard TV time code is not significant. However, it is important to know what type of code is being utilized, and to set up the syunchronization system accordingly.

EBU Time Code

The European TV time code equivalent of SMPTE code is known as EBU (European Broadcasting Union) code. It is very similar to SMPTE monochrome TV code, except that it runs at 25 frames per second, not 30. No drop frame format is required with EBU code.

VITC Time Code

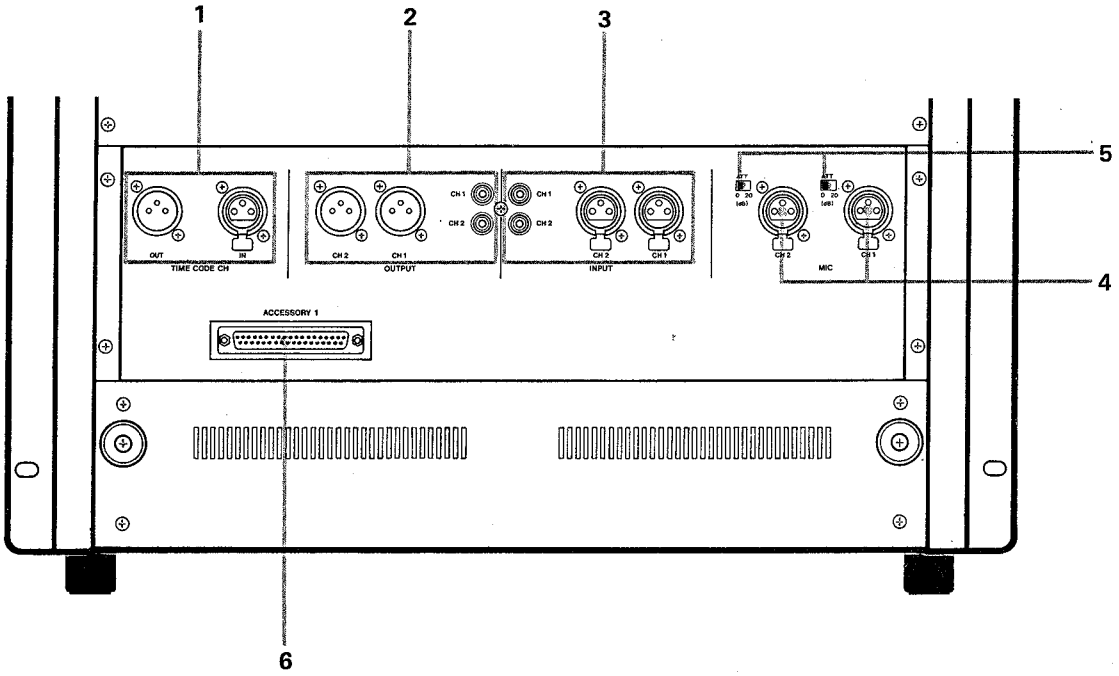
A new format is the Vertical Interval Time Code (VITC). Basically, this is SMPTE TV time code, with a few extra bits for special control codes and error correction. The difference, however, is that instead of recording it in a continuous longitudinal track (recorded in a strip along the edge of the video tape by a fixed audio head), the VITC is recorded in vertical bursts, during the vertical retrace interval, by the rotating video head. This method enables time code to be read while the video image is in "still frame" mode.

Time Code Equipment and Interface to the BR-20

A tape synchronizer using SMPTE/EBU time code, reads the time code from a master machine (ATR or VTR) and from slave machines. It then compares the tape addresses in code of both the master and slave machines, making the slave machine "chase", adjust itself, using fast-forward or rewind mode to a point that corresponds to the tape address on the master. Upon completing the chase maneuver, the synchronizer will place the slave back into play mode. It will continue to monitor the master and slave in this way using the slave's capstan servo control to make any adjustments necessary.

An editing machine also uses time code addresses on tape as a means of monitoring any machines (ATR or VTR) that it is operating. It will use time code addresses to determine precise edit in and out points during the production of "rough cut" or master tapes, and also as cue points to perform any searches necessary.

Using this technology in the video environment improves the quality and quantity of available audio through the increased fidelity of audio dedicated machines and through the adaptability of multitrack audio machines. In audio only application, several multitrack recorders can be synchronized to achieve more available tracks, or multitrack and mixdown machines can be controlled automatically during remix or editing using time code.



5–1. REAR PANEL

1 TIME CODE CH, IN and OUT (BR-20T only) : The IN jack receives time code information from the ES-50 or other time code generators. The nominal input level is 2 Vp-p, balanced. The OUT jack carries the output of the time code channel and connects the synchronizer. The nominal output level is 2 Vp-p, balanced.

2 OUTPUT, CH1 and CH2 : Typically, these are connected to the monitor section of a mixer, or directly to power amplifier inputs.
The major difference between the two sets of jacks is their output level. The XLR type jacks have a nominal output level of +4 dBm, balanced. The RCA jacks have a nominal output level of –10 dBV, unbalanced.
The pin assignment of the XLR type connector : Pin 1 shield (ground), pin 2 low (cold), and pin 3 high (hot).

3 INPUT, CH1 and CH2 : They are for connection to mixer stereo outputs or other line level sources. The XLR type jacks have a nominal input level of +4 dBm, balanced. The RCA type jacks have a nominal input level of –10 dBV, unbalanced.
The pin assignment : Pin 1 shield (ground), pin 2 low (cold), and pin 3 high (hot).

Both the XLR and RCA jacks are active at the same time ; disconnect whatever cable is connected to the jacks not being used.

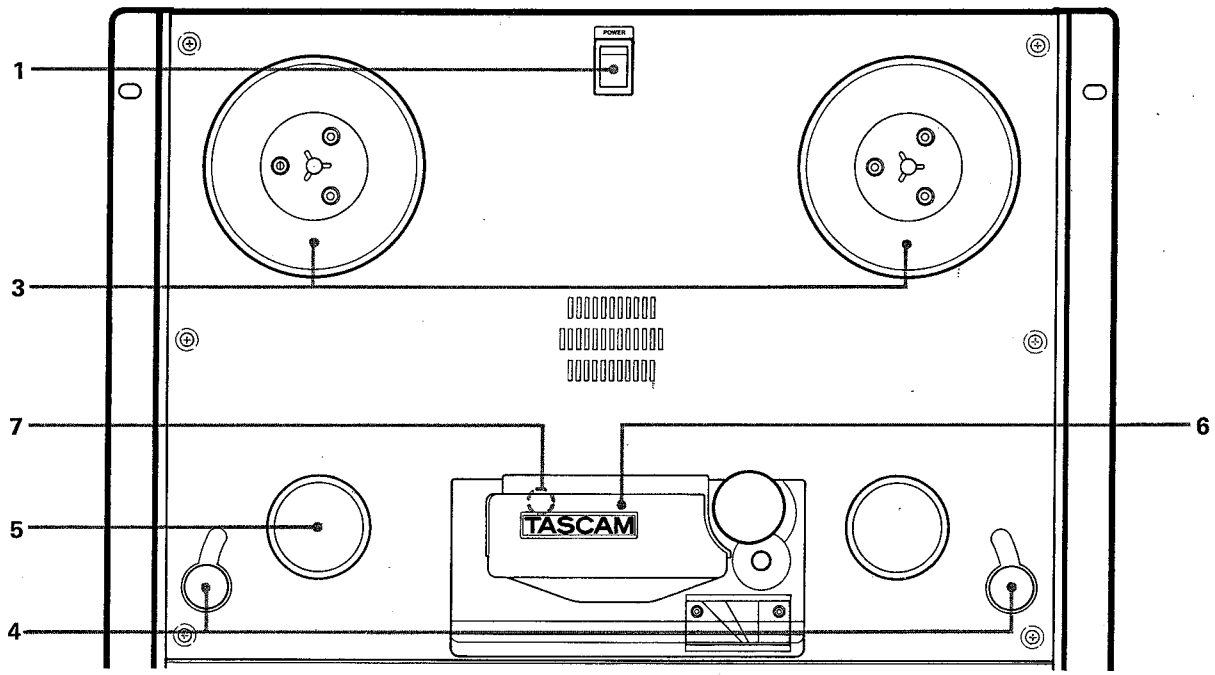
4 MIC Input Jacks, CH1 and CH2 (optional) : Connections for microphones. They accept a minimum input level of –72 dBm (0.195 mV). The maximum input level increases to –23 dBm (54.8 mV) when the ATT switch (item 5) is on. The input impedance is 1.2k ohms.
The pin assignment : Pin 1 shield (ground), pin 2 low (cold), and pin 3 high (hot).

5 MIC ATT Switches (optional) : These switches reduce the MIC input signal by 20 dB before it reaches the mic amplifiers.

6 ACCESSORY 1 Connector (37-pin, D-sub) : It has the inputs/outputs necessary for the direct interface with the ES-50 Synchronizer or other SMPTE/EBU synchronizers/controllers.

Alternatively, this connector may be used for controlling the BR-20 transport from fader start/stop switches, or from the optional RC-402 remote control unit.

An internal DIP switch can be set for the BR-20 to respond only to the fader start command. (See page 12, switch S1–2, and also page 27, #43.)



5–2. FRONT PANEL

1. **POWER Switch** : Controls AC power to the BR-20. As soon as power is turned on, the digital counter shows "8"'s and some indicators light up. After about 3 seconds, the counter shows the tape run time you had before turning the power off and the indicators turn off, indicating the machine's logic circuitry has been initialized (i.e., all the control lines have achieved stand-by status).

   CAUTION : The edge of a running tape could cut your fingers. Be sure to stop the tape before turning the POWER switch off.

2. **NAB Hub Adaptors (not shown in the illustration)** : These can be installed to allow use of large hub 10.5 inch (26 cm) reels.

3. **Reel Tables** : These support 10.5, 7 or 5 inch reels/quarter-inch tapes.
   The separate REEL SIZE selector switches should each be set to the appropriate positions for the size of reel in use.

4. **Tension Arms** : The capstan servo controls the tape tension and motor torque through the use of a position sensor attached to the right tension arm. The right tension arm is also associated with a shut-off mechanism that stops all tape motion if the tape slackens or spills off the reel.
   The left tension arm compensates for slight irregularities in the supply reel in addition to maintaining even tape tension.

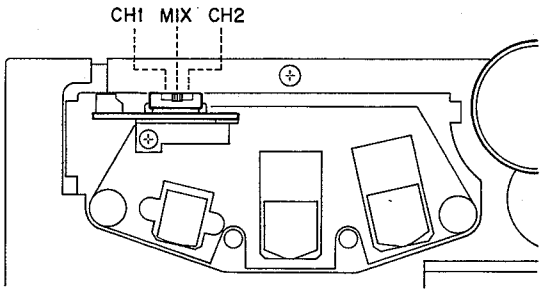
5. **Guide Roller** : Correctly positions the tape along its path.

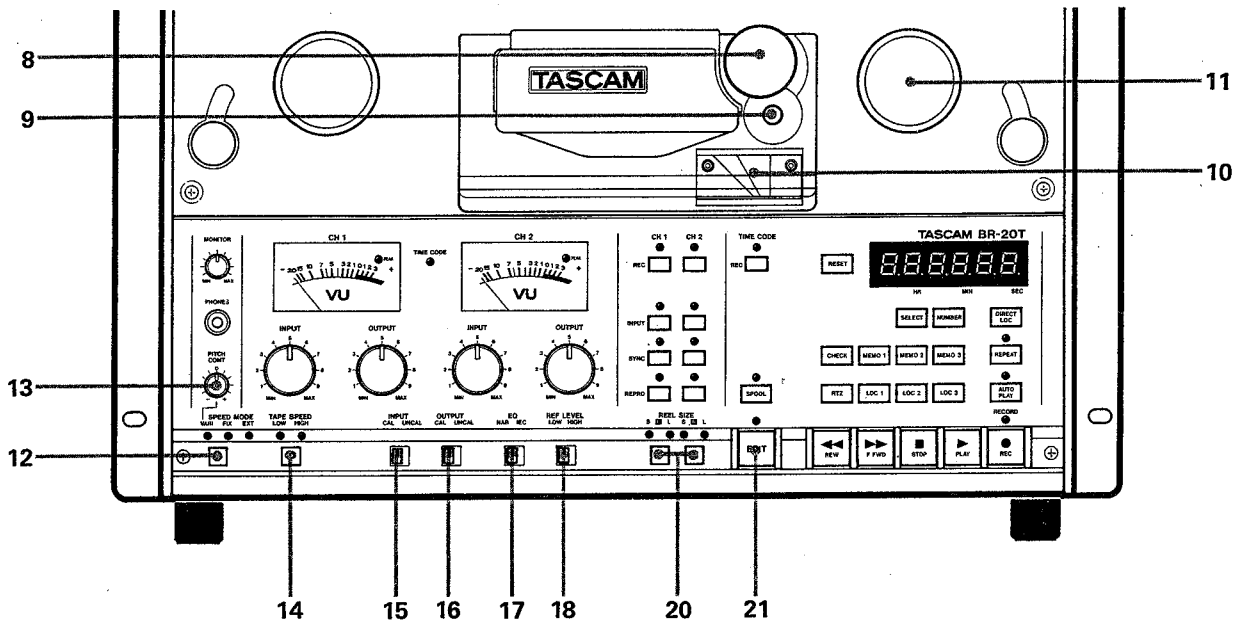
6. **Head Access Cover** : Pull off this cover to get access to the heads for cleaning and splice editing, or to a Monitor Source Selector switch (see the next item, # 7).

7. **Monitor Selector Switch (NAB standard U.S.A./Canada model only)** : This 3-position switch (located beneath the head access cover) controls what signal you hear through the internal local monitor speaker. This does not affect the PHONES output.

   CH1 : for monitoring inputs fed into channel 1 or the output from track 1, depending on the transport modes and the position of the Output Source Selector switches.
   CH2 : for monitoring the channel 2 input or track 2 output.
   MIX : the channel (or track) 1 and 2 signals are combined together.

   - The local monitor speaker can be ordered as an option if not premounted in your BR-20.





8. **Pinch Roller** : The BR-20's pinch roller is a "self-centering" type for maximum tape motion consistency. The rotating components are ball bearing supported for maximum resistance to wearing.

9. **Capstan Shaft**

10. **Splicing Block** : This precision aluminum splicing block has been provided to facilitate editing. Neat, uniform splices can be made by laying the magnetic tape in the slot, and using the block's pre-cut grooves to guide your razor blade.

11. **Counter Roller** : This measures linear tape footage, which is converted into elapsed time from whatever zero point is entered. The counter roller is associated with a tach generator to provide information about tape motion to external synchronizers during fast wind movements .

12. **SPEED MODE Selector Switch** : The switch determines the basic record/playback speed of the transport. One of the three LEDs is always on or flashing to show which speed has been selected.

    FIX: Locks tape speed to 15 ips (38 cm/sec.) or 7.5 ips (19 cm/sec.) as selected by the TAPE SPEED HIGH/LOW switch. Setting to FIX is indicated by a green LED.

    VARI : Switches tape speed control to the PITCH CONT knob. "Non standard" tape speeds can then be used. Setting to VARI is indicated by a red LED.

    EXT : The yellow EXT LED lights solid when the BR-20 capstan motor is under external control of a synchronizer/controller connected to the ACCESSORY 1 connector on the BR-20's rear panel.

    NOTE : Only when both the control and 9.6 kHz reference signals are coming into the BR-20, the EXT speed is active. When either signal is interrupt (due to poor or improper connection), the EXT LED will flash and the FIX LED will turn on solid, indicating the FIX speed is active.

FIX LED	EXT LED	Control Sig.	9.6 kHz Sig.	External Control
On Solid	Off	Both signals are not coming in.		NO
On Solid	Blink-ing	Only either the control or the 9.6 kHz signal is coming in.		NO
Off	On Solid	Both the control and the 9.6 kHz signal are coming in.		YES

13. **PITCH CONT(rol) Knob** : When and only when SPEED MODE selector switch is in its VARI position and its red LED is on, the PITCH CONT is active and provides a stepless plus or minus 12% variation to the capstan motor speed both in record and play modes. Turn the knob to the left to lower the motor speed, or to the right to increase the speed.

    You can use this speed control to accommodate minor changes necessary in the length or relative pitch of your program material. If you're making a 30 second radio

commercial and it runs a litte long, you can speed it up enough to drop out the extra seconds, although the material on it will raise in pitch. This can sometimes be used in a creative way to save parts that are a litte out-of-tune, or to create sound effects such as flanging. If you record with the PITCH CONTROL at its maximum or minimum settings, you will NOT have the ability to make further adjustment in that direction upon playback.

Also, it is recommended that you run the BR-20 for several seconds in the play mode for the speed to stabilize, especially when the change in speed is large. Before beginning to record again, check the pitch carefully with a short playback, and you will have less troubles with drift.

CAUTION : The PITCH CONTROL affects the record speed also. Check to make sure that the SPEED MODE selector switch is set to FIX unless you are using the PITCH CONTROL intentionally.

14. **TAPE SPEED Selector Switch :** allows selection of two tape speeds during recording and playback modes. HIGH (green LED) for 15 in/s (38 cm/s) and LOW (orange LED) for 7.5 in/s (19 cm/s).

15. **INPUT CAL/UNCAL Switch :** When this switch is placed in the left/CAL position, the CH 1 and CH 2 INPUT level controls are bypassed and the input level is passed to the outputs without receiving any level alteration. This CAL position is generally used for system calibration (level alignment).
When the switch is set to its right/UNCAL position, the INPUT level controls are active, affecting the input signals.

16. **OUTPUT CAL/UNCAL Switch :** Similar to the INPUT CAL/UNCAL switch (item 15) ; when placed in the right/UNCAL position, this switch activates the CH1 and CH 2 OUTPUT level controls.

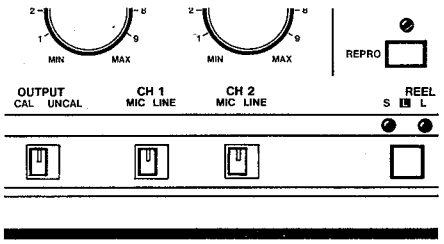
17. **EQ Selector Switch, NAB/IEC:** Different brands of tape require different equalization curve. Set this switch to match the type of tape in use for best frequency response and signal-to-noise ratio.

    - When the optional MIC inputs are mounted, the EQ switch on the standard models gives place to CH 1 MIC/LINE switch and the EQ selection is made by a DIP switch on the MIC AMP PC Board.

18. **REF LEVEL Selector Switch :** Set this switch to match the type of tape being used. The HIGH position provides a 0-vu reference reading for standard 320 nWb/m level (or 514 nWb/m on "European" models), and the LOW position provides a 0-vu reading for 250 nWb/m (or 320 nWb/m on "European" models).

    - When the optional MIC inputs are mounted, the REF LEVEL switch on the standard models gives place to CH2 MIC/LINE switch and the REF LEVEL selection is made by a DIP switch on the MIC AMP PC Board.

19. **CH1 and CH2 MIC/LINE Input Selector Switches (optional):** Used to determine which input, mic or line, is fed into the separate channels.

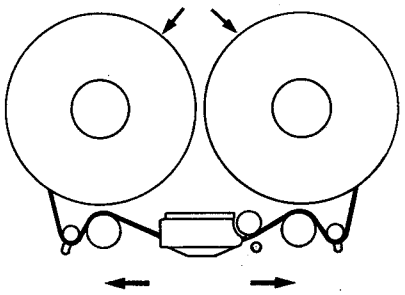


20. **REEL SIZE Selector Switches :** These should be set to match the size of reel in use for optimum tape tension and smooth tape behavior. L(arge) for 10.5 inch reels, and S(mall) for 7 or 5 inch reels, separately for the supply and the takeup side.

21. **EDIT Key :** This key provides the following 7 functions.

1) Manual Edit : When the transport is in STOP and the right (takeup) tension arm is in its up/"on" position, pressing EDIT will turn on its LED and disengage the reel motor brakes, and the same amount of torque will be exerted on both reels. The reels may be "hand rocked" to locate the exact edit points while you hear the tape.

Move by hand backwards and forwards



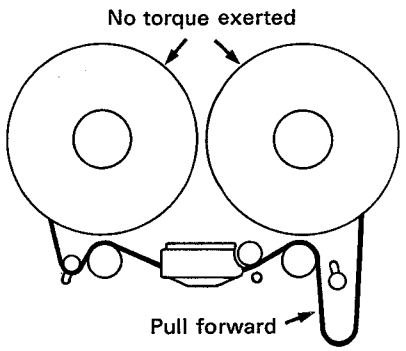
Cueing out the edit points

2) **"Quick Cueing"** : While in Manual Edit mode (above), if you hold REW or F.FWD, the tape lifters will retract so the tape contacts the heads, allowing you to hear tape as it runs at REW or F.FWD speed.

A high-cut filter is automatically inserted to prevent the meter circuits and speaker components from being damaged by high-energy audio signals.

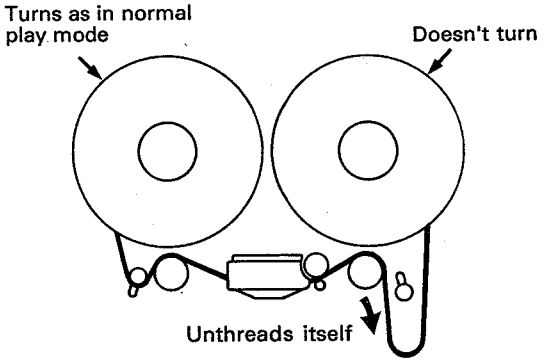
3) **Intermediate Speed Cueing** : Holding EDIT together with REW or F.FWD in Manual Edit mode, you will hear tape as it runs at about half times the normal fast wind speed.

4) **Stop Edit** : When the transport is in STOP and the right tension arm is dropped to its "off" position, pressing EDIT will turn on its LED and disable the output mute. The tape may then be pulled forward off the supply reel as you listen to it play.



5) **Dump Edit** : If EDIT and PLAY are simultaneously pressed when the transport is in STOP, the EDIT LED will turn on and the tape will begin unthreading itself from the supply reel as you listen to it play. The right tension arm position is disregarded by the shut-off sensing logic.

To stop the tape motion and quit the mode, press STOP.



6) **Spot Erase** (not available on the NAB standard U.S.A./Canada model) : This function makes it easy to erase specific portions on a given track. First, designate the track to be erased by pressing its REC Enable switch. In Manual Edit mode, hold the master REC key while slowly moving tape by hand. Erase continues for as long as you advance the tape with REC held down.

CAUTION : The key to a clean Spot Erase is keeping constant tape speed before, during, and after the pressing and releasing of the record key. If the record function is activated before tape movement or deactivated after the tape has stopped, an audible click will be left on the tape. If you are not already familiar with using spot erase, we advise you to practice before attempting the spot erase function on master recordings.

7) **High-speed Cueing** : This is similar to the "Quick Cueing". Hold EDIT during the fast winding modes (including SPOOL and LOCATE). For as long as you hold EDIT, you can hear tape.

As in "Quick Cueing" mode, a high-cut filter is automatically inserted.

NOTE : Pressing PLAY after EDIT only causes the tape to play normally. To activate Dump edit mode, hold EDIT and press PLAY, or press both simultaneously.

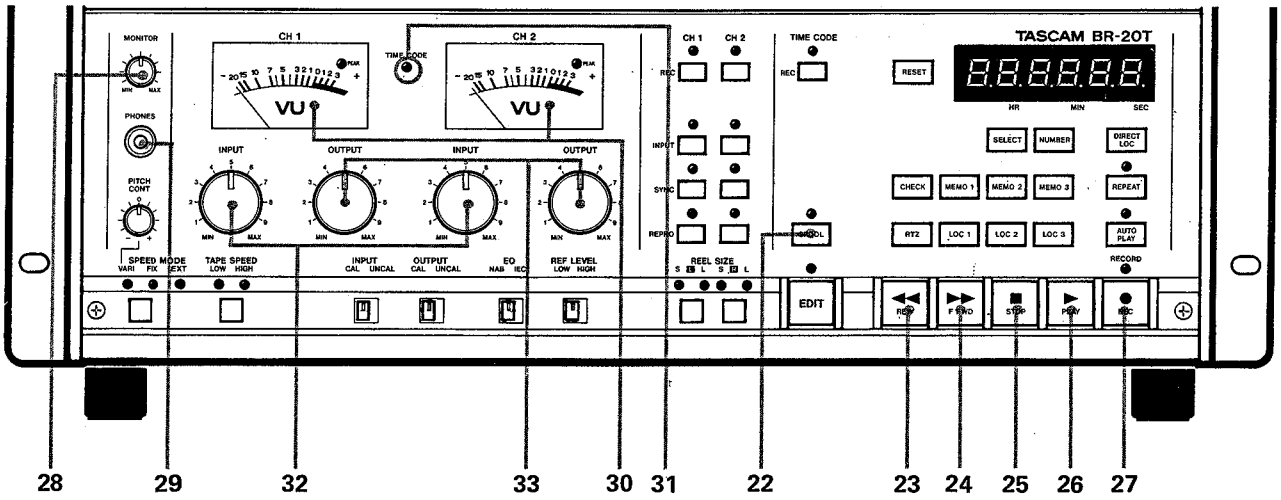
22. **SPOOL Switch** : When this switch is pressed after (or before) REW or F.FWD, the tape will begin rolling at a constant speed of about 100 ips (2.5 cm/s), which is 1/3 times the normal fast wind speed, to obtain a tight, uniform tape pack. Generally, spooling will be done onto the takeup reel at the end of a recording or editing session so the tape can be stored "tails out", which reduces audible print-through effects (pre-echoes).

23. **REW Key** : a) Winds the tape at high speed in reverse if pressed in STOP. b) Holding the key while in EDIT (or, inversely, holding EDIT while in REW) offers reverse tape cueing.

24. **F.FWD Key** : Similar to REW. a) If pressed in STOP the key winds the tape at high speed in the forward direction. b) Holding the key while in EDIT (or, inversely, holding EDIT while in F.FWD) offers forward tape cueing.

25. **STOP Key** : Stops any tape motion, and disables all transport modes.

26. **PLAY Key** : a) Pressing this key alone starts playback. b) Pressing the key during recording stops the recording ("punch out") without stopping the tape motion.



27. **REC Key :** Pressing REC together with PLAY will cause either of the following events :

    1) If either or both tracks' REC Enable switches are on, the track LED(s) turn on solid, and recording will begin.

       - Recording can also be initiated by pressing REC during PLAY.

    2) If both tracks' REC Enable switches are off, the master REC LED will blink to indicate a record ready.

The above 5 keys (REW, F.FWD, STOP, PLAY, and REC) can optionally be laid out to match your preference. Consult TASCAM or your nearest TASCAM dealer.

28. **MONITOR Level Control :** Adjusts the listening level of the headphones plugged into the PHONES jack.

    NAB standard U.S.A./Canada model — Plugging headphones into the PHONES jack electronically disconnects the internal local monitor speaker. Disconnect the headphones for the internal speaker to be active. For as long as the PHONES jack is empty, the MONITOR level control affects the level fed to the internal monitor speaker.

29. **PHONES Jack :** For connection to stereo headphones only. Don't use 2 conductor mono headphones with this jack.
    The built-in headphone amplifier is rated at 150 mW into 8 ohm load.

30. **VU-meters with PEAK Indicator :** The meters register Input and Tape signals. Whether measured signals is Input or Tape depends on both the transport modes and the setting of the Output Source Selector switches (item 35).

    The meters will read 0 VU when a signal of +4 dBm is fed into the XLR type input jacks or a signal of –10 dBV into the RCA input jacks.
    The PEAK indicator is designed to light at 12 dB (if REF LEVEL is at LOW) or 10 dB (with REF LEVEL at HIGH) above nominal input level. If the PEAK indicator constantly lights, turn down the INPUT level control until the indicator flashes only occasionally.

31. **TIME CODE Indicator (BR-20T only) :** Lights to indicate time code is being fed into the time code channel of the BR-20T. Also lights up in playback of the time code track.

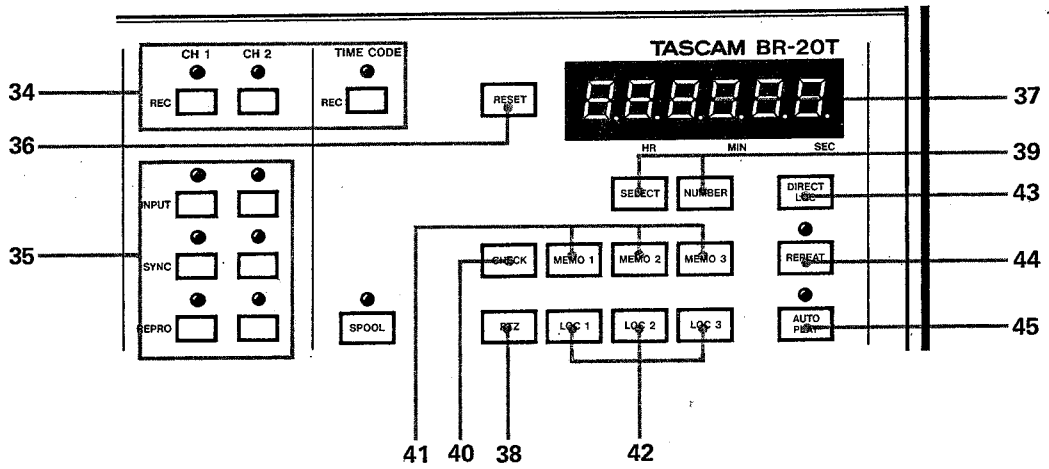
32. **INPUT Level Controls :** These controls set the level of their respective channel's inputs (both XLR and RCA jacks).

    They are used for recording level/balance adjustments.

    - Active only when their respective INPUT CAL/UNCAL switches are in UNCAL position.

33. **OUTPUT Level Controls :** These controls set the level of their respective channel's outputs (both XLR and RCA jacks), and are used for playback level adjustment.

    - Active only when their respective OUTPUT CAL/UNCAL switches are in UNCAL position.



34. REC Enable Switches : These switches put the respective tracks into Record Ready, or directly into Record mode if the master REC and the PLAY key have already been pressed.

Functions of the track REC LEDs

a) LED off : safe — no recording cannot occur on that track.

b) LED blinking : record ready — recording on that track will occur when the master REC and the PLAY key are pressed.

c) LED on solid : record mode — recording is taking place on that track.

35. Output Source Selector Switches : These switches determine the source of the signal which is fed to the output connectors, the VU meters, and the PHONES jack, as follows :

INPUT (red LED) : Selects the input to the track (primarily for alignment). This is the same as the E-to-E function on a video tape machine.

SYNC (orange LED) : Selects the rec/sync head signal for synchronous playback, or the input signal, as follows :

When the transport is in Play mode, the output of the channel whose REC enable switch is on (its LED blinking) is fed with the respective track signal; and when the transport switches to Record mode, that output is fed with the input signal.

REPRO (green LED) : Select signal from the repro head. This is used primarily for alignment or evaluation of the quality of the recorded signal, although it can be used during mixdown. Actually, the SYNC and REPRO head performance is equivalent, so there is no need to use REPRO for mixdown.

NOTE : During recording you can toggle INPUT and REPRO, but can't toggle from these to SYNC. If you press SYNC after recording has started, the monitor will switch to SYNC only at the punch-out moment. Similarly, if you press INPUT after recording has started in SYNC, the monitor will switch to INPUT at the punch-out moment, allowing you to continue to monitor the input signal.

Output Source Selector Sw.	Track REC Enable Sw.	Transport Mode	Monitor Source
INPUT	N/A	Stop	Input
REPRO	N/A	Play	Tape
SYNC	On	Play	Tape
		Record	Input
	Off	Play	Tape
		Record	

N/A = not applicable ; the REC switch on/off has no effect on the output source.

- **On the BR-20T only** : the green REPRO LED will flash at slow rate to indicate the time code track is not read off in sync with the audio tracks. Prevent or defeat this problem by setting the Output Source Selector switch to SYNC.

36. RESET Switch : When pressed, this switch resets the digital display to 00000. Used to mark the record start point or any other points on the tape. The tape will be located to that point by pressing the RTZ (Return-To-Zero) key.

Pressing RESET has no effect when the counter is in SELECT/NUMBER and CHECK modes (see below).

37. **Digital Tape Time Counter** : This 5-digit display shows elapsed time in hours, minutes and seconds.
The maximum readout time is 9 hours, 59 minutes, 59 seconds, and the minimum readout time is –9 hours, –59 minutes, –59 seconds.

    The elapsed time is calculated from the speed setting. When SPEED is set to LOW, the information from the capstan motor is automatically multiplied by two for you.

38. **RTZ (Return-To-Zero) Key** : When this key is pressed in whatever the current transport mode is, "00000" will flash in the counter for a fraction of a second then the tape will fast wind to the counter 00000 point. If AUTO PLAY is active, the tape will automatically start playing back after reaching the counter zero point.

39. **SELECT Key** : When this is pressed for the first time, the digital display switches to MEMO point setting mode.

    Each time SELECT is pressed, a blinking "0" will move left.

    Each time NUMBER is pressed, blinking numbers scroll up.

    When the desired location time is entered, press one of the three MEMO keys. That point is loaded into the corresponding MEMO register and the counter switches back to the normal tape time display mode.

    For more details on SELECT, see the "Operation" section of this manual (pp. 16-17).

40. **CHECK Key** : When this key is pressed, the counter will switch to show a broken line. Holding then any MEMO key causes the counter to show the content of the corresponding register.

    When REPEAT play is in progress, or in Ready with its LED blinking, if CHECK is pressed then REPEAT is held, the counter will show which of the three MEMO is assigned to the start point of the loop and which MEMO is assigned to its end point.

    NOTE : Pressing CHECK during SELECT/NUMBER operation clears the numbers you entered and the display switches back to tape run time mode.

41. **MEMO Keys 1–3** : These three keys are used to load tape locations defined by SELECT/NUMBER into the respective registers, or to capture the current tape location.

    "On-the-fly" MEMO entry :
    When any of the MEMO is pressed while tape is playing, the counter shows a broken line for 3 seconds, then the readout you had the moment MEMO was pressed is loaded into that memory register. The BR-20 can optionally be modified so the tape point captured by hitting MEMO is stored into memory only when NUMBER is additionally pressed. (See page 12, "S2-1".)

42. **LOC Keys 1–3** : Pressing any of these three keys causes the tape to roll (in either REW or F.FWD) to the corresponding MEMO point. The instant LOC is pressed, the counter display will show the location point for a fraction of a second.

    If AUTO PLAY is active, the tape will automatically start playing back as soon as a MEMO point is reached.

43. **DIRECT LOC Key** : If this key is pressed instead of MEMO at the end of SELECT/NUMBER operation, the tape will be located to the point you've entered via SELECT and NUMBER.

    If DIRECT LOC is pressed during any other operations than SELECT/NUMBER, the counter will show for a fraction of a second the beginning point of the last record or play (whichever you performed after the other) and the tape will be located to that point. If AUTO PLAY is active, the tape will start playing from that point.

    Fader Start Function On/Off Switching

    Holding STOP and pressing DIRECT LOC will switch the fader start (not stop) function on and off. Each time DIRECT LOC is pressed, the leftmost dot in the counter display will turn on and off, showing that the BR-20's transport can (dot off) or cannot (dot lit) be started from external fader switches.

    The fader stop function on/off switching is a task of a DIP switch (see page 12).

44. **REPEAT Switch** : The REPEAT function provides a "playback loop" or "block repeat" between the desired two of the three MEMO points. The machine understands the lower memory point as the start point of loop, and the higher point, as the end.

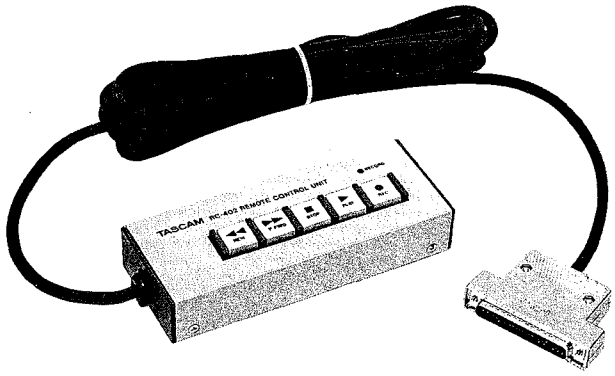
    For more details see the Operation section of this manual, p. 17.

45. **AUTO PLAY Switch** : This switch programs the BR-20 to start playback after any of these search operations : DIRECT LOC, LOC 1–3, and RTZ.

    The AUTO PLAY switch can be pressed before or after starting the search operation.

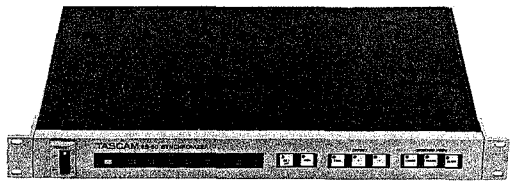
SECTION 6 OPTIONAL ACCESSORIES

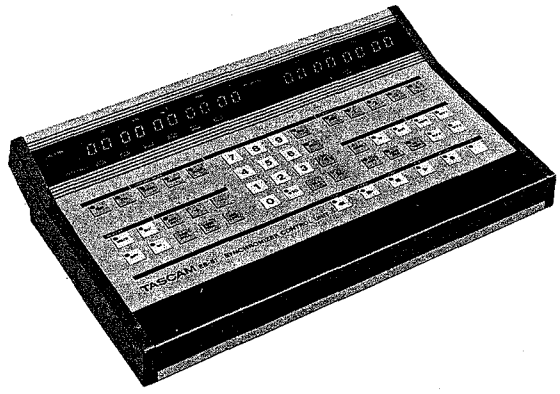
Remote Transport Control Unit



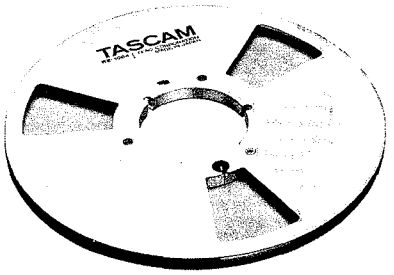
This comes equipped with a 15-foot (5-meter) cable that plugs into the ACCESSORY 1 connector of the BR-20, and controls the basic tape motions (REW, F.FWD, STOP, PLAY, and REC).
This can also be used to control the TASCAM MSR-24/16 and TSR-8 tape transports.

SMPTE/EBU Synchronizer/Controller

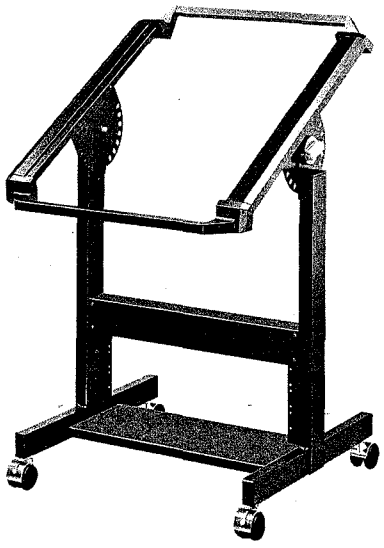




RE-1004 10-1/2" Metal Reel (for 1/4 inch wide tapes)



CS-608/607B Console Rack



Mic Amplifier Kit

Lets the BR-20 accept two microphone signals. The kit includes a two-channel input amplifier assembly with two input jacks and attenuator switches.

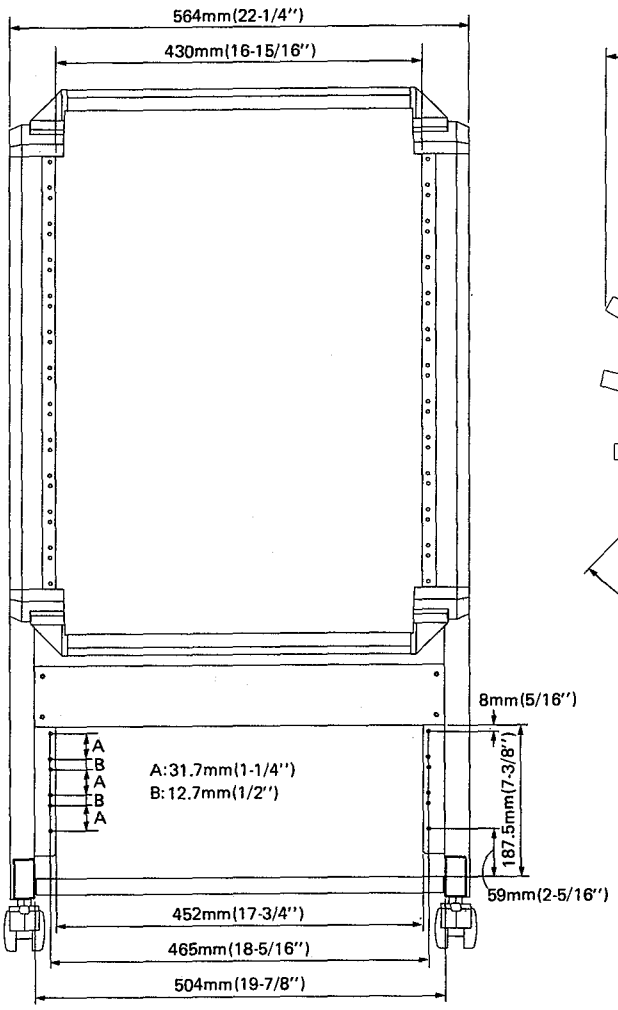
Monitor Speaker Kit

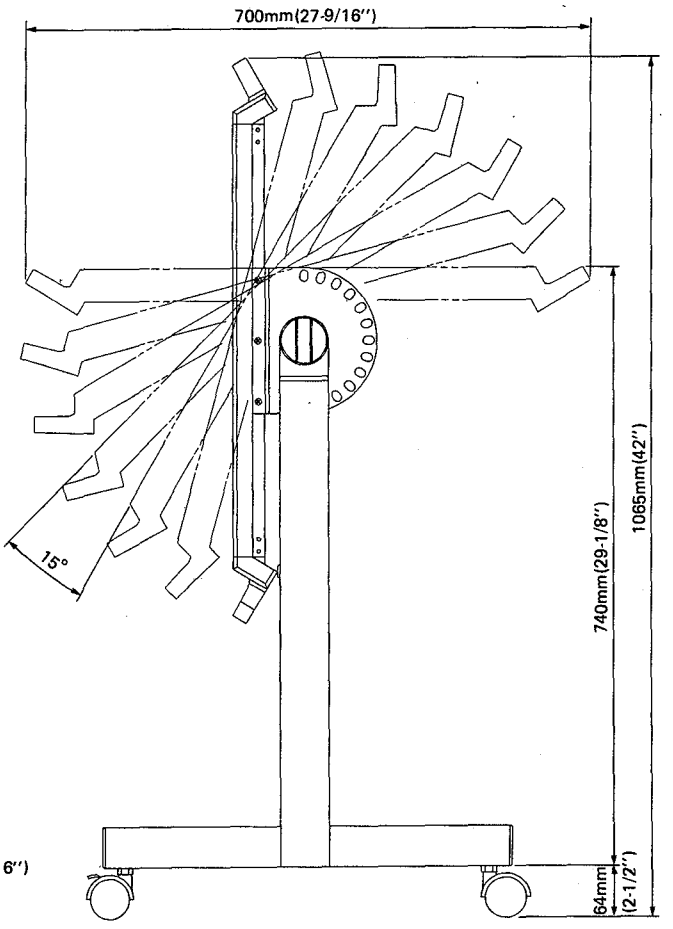
This is a local monitor speaker assembly to be mounted in the BR-20. The monitor source can be channel 1, channel 2, or both channels mixed together, as required. (Premounted in the NAB standard USA/CANADA model.)

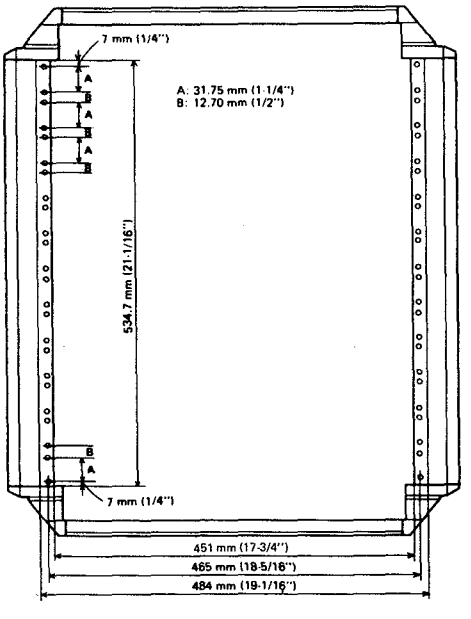
TZ-261 Cleaning Kit (Except U.S.)

HC Head Cleaner & RC Rubber Cleaner (U.S. only)

CS-608 DIMENSIONS







SECTION 7 CARE AND MAINTENANCE

We can't stress the importance of cleaning and demagnetizing too much. Oxide shed from the tape and accumulated on the heads and other components in the tape path and dust or debris picked up from the air can result in poor high frequency response. Also, the heads may become magnetized. This residual magnetism can increase noise and distortion, significantly degrading record/reproduce performance. Clean up and demagnetize at least every day before you start to work with the BR-20.

CLEANING

1. Remove the head cover to get full access to the heads. See "How to Remove ...", page 11.

2. Apply cleaner to a cotton swab or lint-free gauze and wipe the entire surface of the tape path. Wipe off any excess cleaning fluid with a dry swab.

CAUTION : Be sure to use a good cleaner. We recommend the following:
TEAC CH-1 (U.S. only) or TZ-261A (for heads, tape guides, guide roller, counter roller, and capstan shaft); and
TEAC RC-1 (U.S. only) or TZ-261B (for pinch roller).

DEGAUSSING (DEMAGNETIZING)

A little stray magnetism can become quite a big nuisance in tape recording. It only takes a small amount (.2 Gauss) to cause trouble on the record head. (Gauss is the unit used to measure magnetism.) A little more than that (.7 Gauss) will start to erase high frequency signals on previously recorded tapes. You can see that it's worth taking the trouble to degauss regularly.

DEGAUSSING IS ALWAYS DONE WITH THE RECORDER TURNED OFF. If you try it with the electronics on, the current pulses produced by the degausser will look just like audio signals to the heads. These pulses are around 10,000 Gauss, and will seriously damage the electronics and/or meters. Turn off your BR-20, then turn on the degausser at least 1 m (3 feet) away from the recorder.

Be certain that your degausser has either a plastic cover or plastic tape covering the tip. Make sure that no metal ever touches the tape heads as it will scar them and ruin them.

Slowly move in to the tape path. Move the degausser slowly back and forth, touching lightly all metal parts in the tape patch. Slowly move it away again to at least 1 m (3 feet) from the recorder before turning it off.

Be sure to concentrate while you are degaussing. Don't try to hold a conversation or think of anything else but the job you are doing. If the degausser is turned on or off by accident while it is near the heads, you may put a permanent magnetic charge on them that no amount of careful degaussing will remove. You will have to get the heads replace. Make sure you are wide awake for this job.

A clean and properly demagnetized tape recorder will maintain its performance without any other attention for quite a while. It won't ruin previously recorded material, nor will getting it back to original specifications be difficult.

MAINTENANCE

"CAUTION — THESE SERVICE INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO. REFER ALL SERVICING TO QUALIFIED SERVICE PERSONNEL."

INSTRUCTIONS FOR SERVICE PERSONNEL

BEFORE RETURNING APPLIANCE TO THE CUSTOMER, MAKE LEAKAGE-CURRENT OR RESISTANCE MEASUREMENTS TO DETERMINE THAT EXPOSED PARTS ARE ACCEPTABLY INSULATED FROM THE SUPPLY CIRCUIT.

NOTES

- ★ Parts marked with * require longer delivery time.
- ★ All resistors are 1/4 watt, 5 % unless marked otherwise. Resistor values are in ohms (K=1,000 ohms, M=1,000,000 ohms).
- ★ All capacitor values are in microfarads (p=pico-farads)
- ★ ⚠ Parts marked with this sign are safety critical components. They must always be replaced with identical components — refer to the TEAC Parts List and ensure exact replacement.
- ★ 0 dB is referenced to 1 V in this manual unless otherwise specified.
- ★ PC boards shown viewed from electro-parts side.

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1. PARTS LOCATIONS

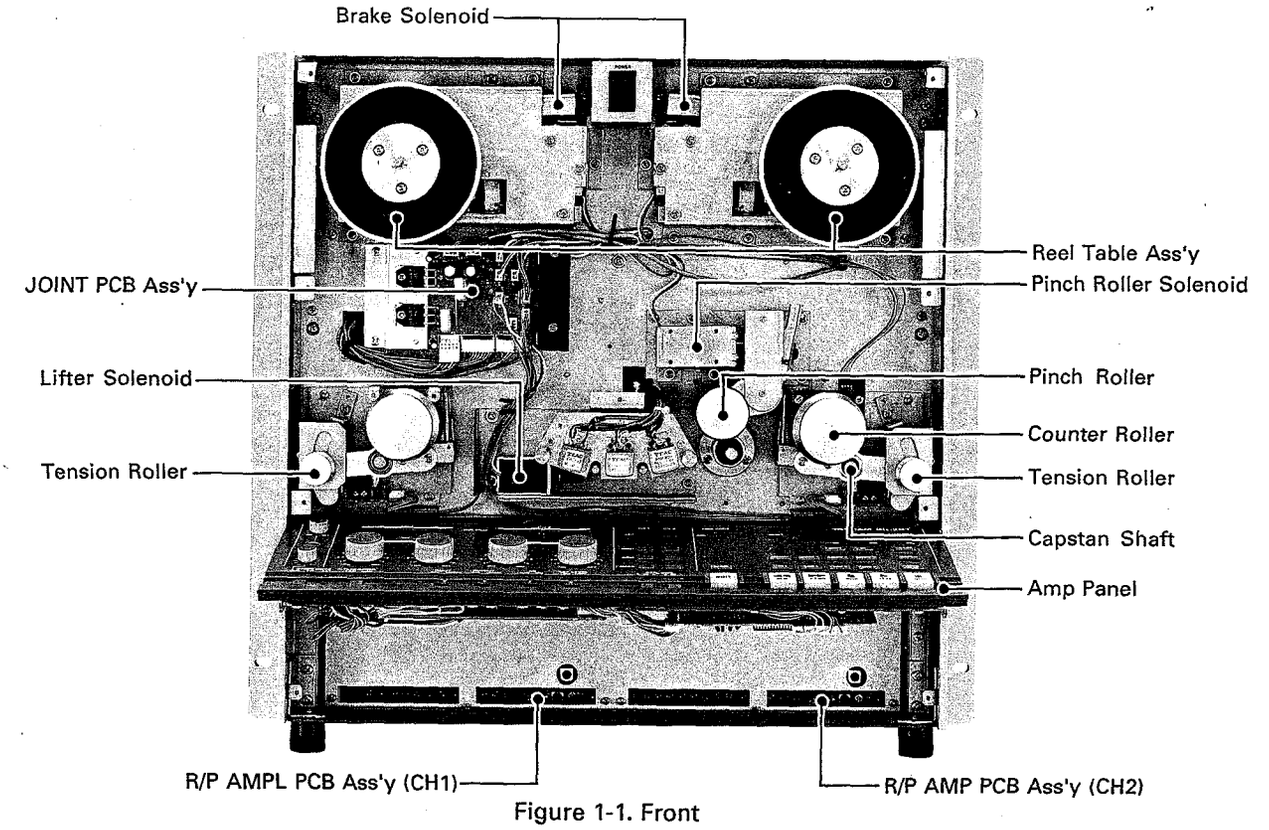


Figure 1-1. Front

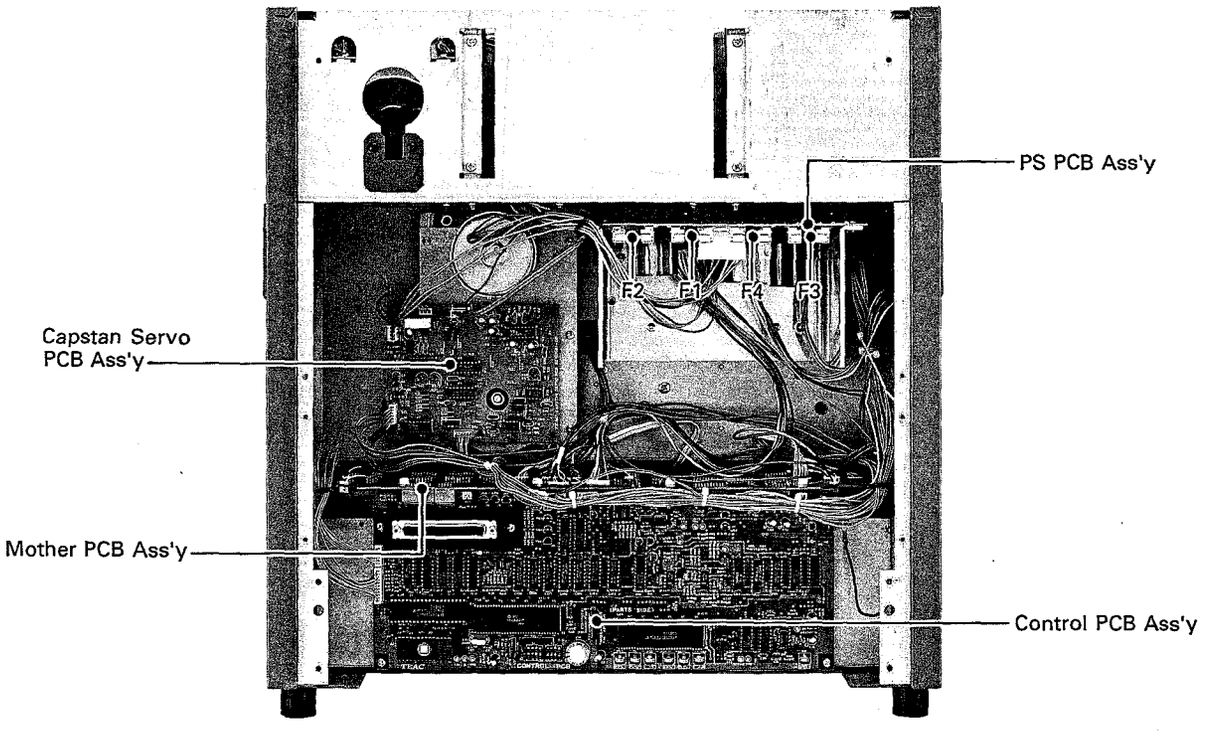


Figure 1-2. Rear

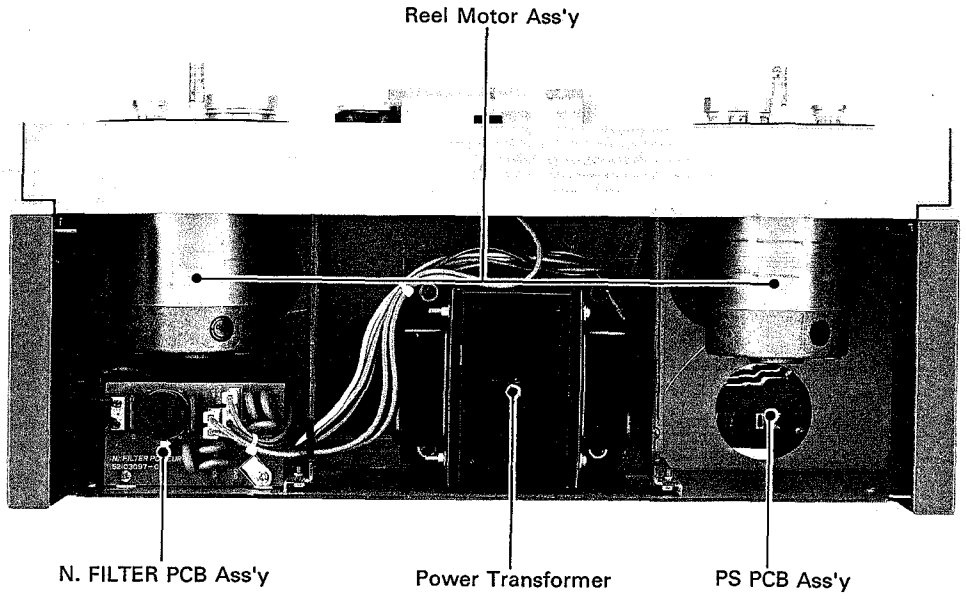


Figure 1-3. With Top Rear Panel Removed

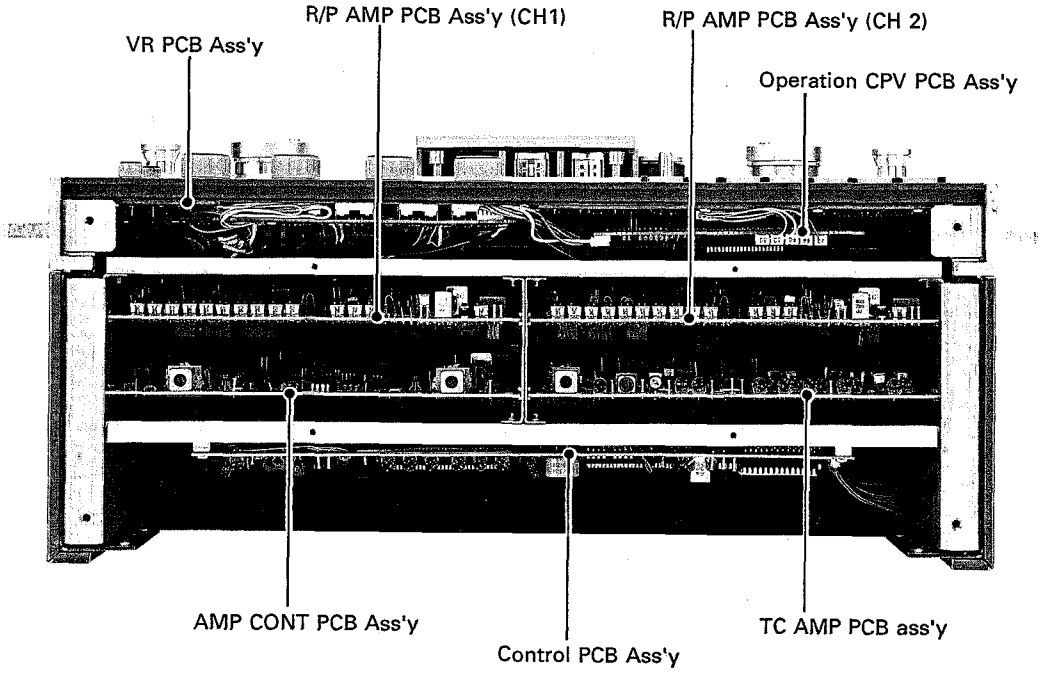


Figure 1-4. With Bottom Panel Removed

2. TEST EQUIPMENT

Wow & Flutter Meter : Minicom Division, 3M Co., Model 8155
Audio Oscillator : Hewlett Packard, Model 204C or equivalent
Digital Frequency Counter : Range :10 Hz to 1 MHz; Sensitivity : 0.1 Vrms; Imp.: > 1M ohms, < 25 pF
Band-pass Filter : 1 kHz narrow band pass type
AF Level Meter : Range : –80 dB to +40 dB ; Imp.: > 1M ohms, < 25 pF (such as HP 400GL)
Distortion Meter : General type (400 Hz, 1 kHz)
Oscilloscope : General type
Attenuator : General type
Tool:
Spring scale : 0 to 8 lbs (0 to 4 kg)
0 to 2.2 lbs (0 to 1 kg)
Tentelometer : Model TS-H20-1 or TS-H20-M2
Hex head Allen wrenches
Plastic alignment tool
Cleaning Fluid : TEAC TZ-261 or equivalent
Head Demagnetizer : TEAC E-3 or equivalent
1/4" Test Tape :
Tape speed/Wow flutter test tape :
TEAC YTT-2004 (for 15 ips);
TEAC YTT-2003 (for 7-1/2 ips).
Reproduce alignment test tape :
NAB Equalization:
TEAC YTT-1004 (for 15 ips);
TEAC YTT-1003 (for 7-1/2 ips).
Reference fluxivity: 185 nWb/m
Time constant : 3,180 +50 usec.
IEC Equalization:
TEAC YTT-1064 (for 15 ips)
Reference fluxivity: 320 nWb/m
Time constant : ∞ +35 µsec.
TEAC YTT-1063 (for 7-1/2 ips)
Reference fluxivity: 320 nWb/m
Time constant : ∞ +70 µsec.
Blank test tape (for recording) : AMPEX 456

3. VOLTAGE CONVERSION

This machine is adjusted to operate on the electric voltage specified on the machine, power cord tag, or packing carton.

NOTE : This voltage conversion is not possible on models sold in the U.S.A., Canada, UK, Australia or Europe.

For general export models, if it is necessary to change the voltage requirements of your machine to match the line voltage at the installation site, use the following procedure.

ALWAYS DISCONNECT THE POWER LINE CORD BEFORE MAKING THESE CHANGES.

1. Remove the right side panel by removing six screws (see Figure 4-2).
2. Locate the voltage selector plug (see Figure 3-1).
3. Pull out to remove the plug, and reinsert it so that the required voltage is indicated in the cut-out section of the plug.

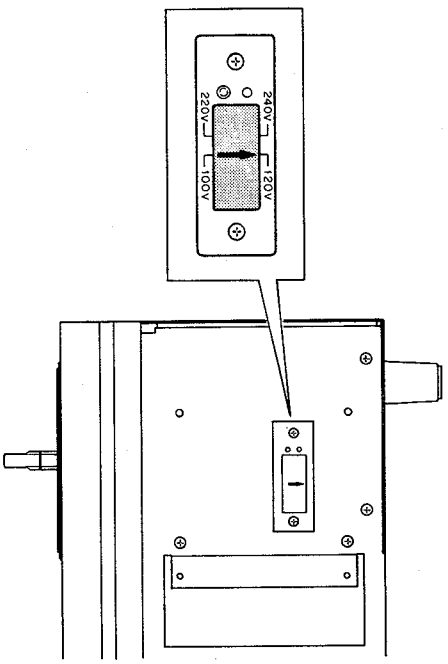


Figure 3-1. Voltage Selector Location

4. PANEL REMOVAL

WARNING : To avoid electric shock, be sure to unplug power cord prior to removing or replacing any parts.

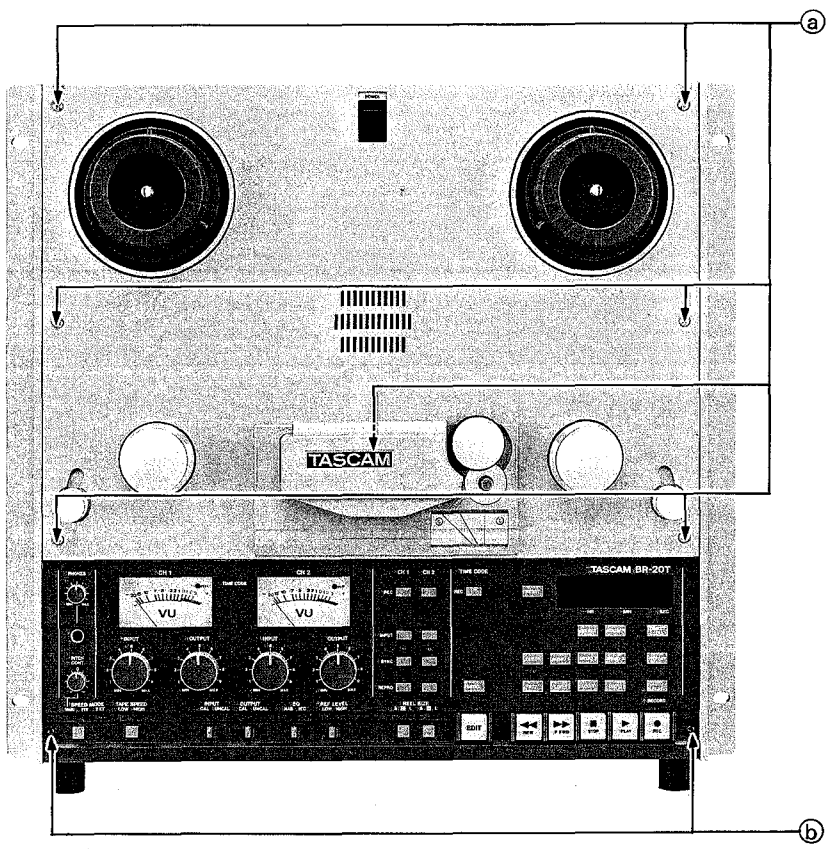


Figure 4-1. Screw Locations for Removing Front Panel and Pushing Control Panel Open

4-1. Front Panel

1. Remove the head housing (access cover) and the pinch roller as follows :

   To remove the head housing, gently press the left side of the cover to the right and lift the left side up slightly. Then pull and lift to the left to release fully. When replacing the cover, first insert the tab into the slot on the right side of the head assembly, then gently press the left side in to lock it into position. DON'T FORCE IT. Carefully handle both in removing and replacing.

   To remove the pinch roller, unscrew its cap by turning it counterclockwise and remove the cap and pinch roller.

2. Remove the seven "a" screws (Figure 4-1).

4-2. Control Panel

Remove the two "b" screws (Figure 4-1). The panel can then open as shown in Figure 1-1.

4-3. Side Panels

Remove the six "c" screws (Figure 4-2).

4-4. Top Rear Panel

Remove the four "d" screws, two of which hold the feet in place (Figure 4-3).

4-5. Connector Panel

Remove the four "e" screws (Figure 4-3).

4-6. Lower Rear Panel

Remove the four "f" screws (Figure 4-3).

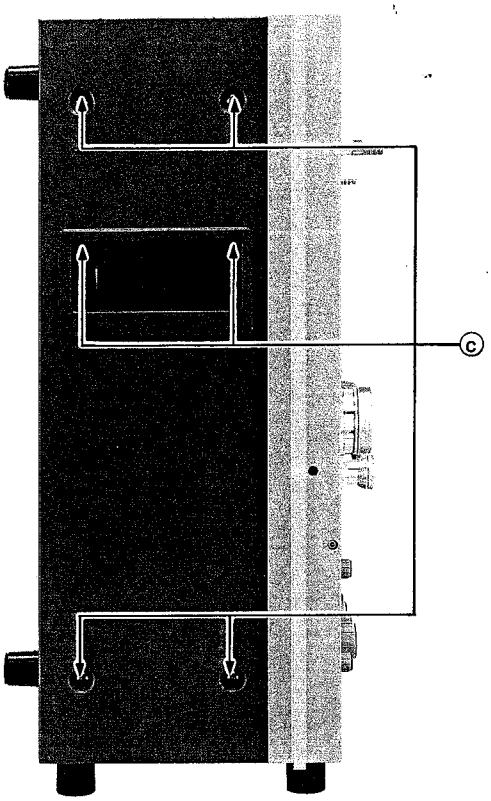


Figure 4-2. Screw Locations for Side and Top Rear Panel Removal

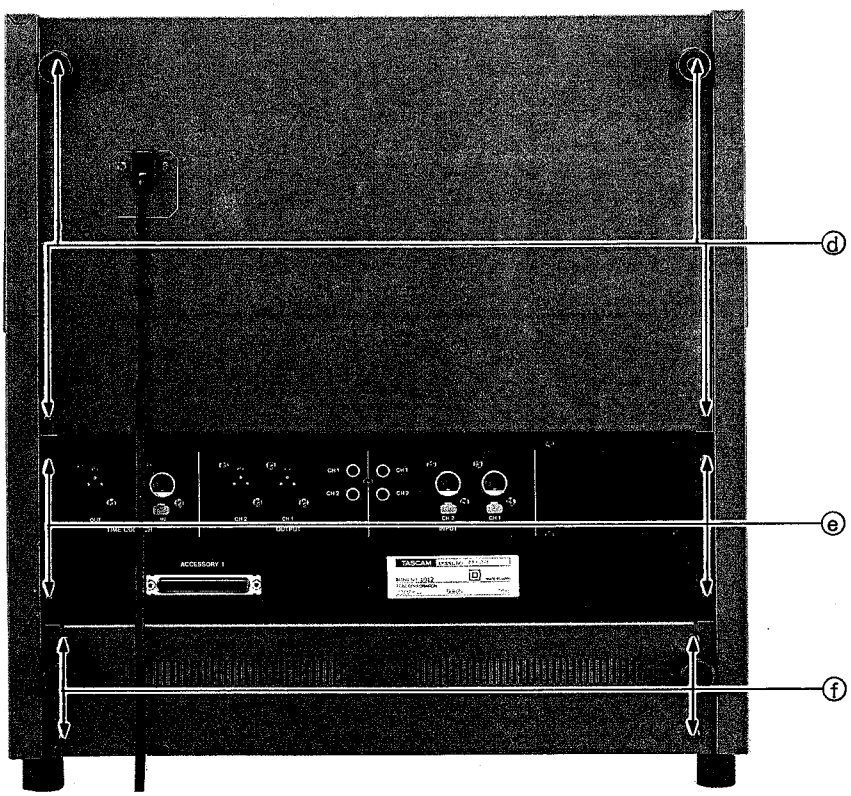


Figure 4-3. Screw Locations for Connector and Lower Rear Panel Removal

4-7. Bottom Panel

Remove the eight "g" screws, four of which hold the feet in place (Figure 4-4).

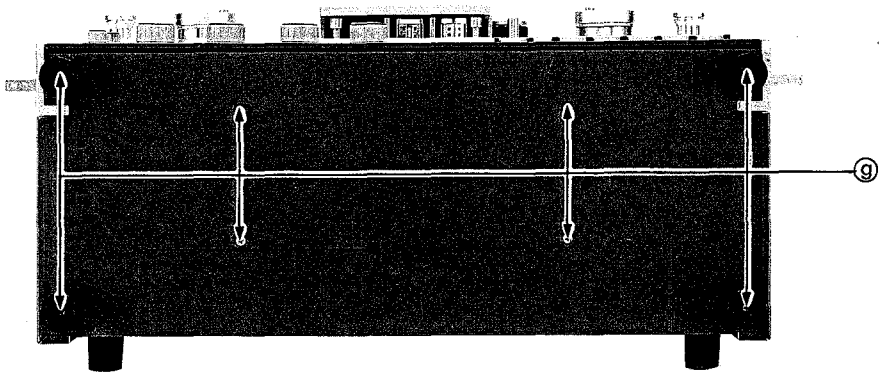


Figure 4-4. Screw Location for Bottom Panel Removal

4-8 Fuse Replacement

CAUTION : First, check to make sure the power is turned off.

If a fuse has blown, retrace the cause and eliminate it before replacing it with a new one.

NOTE : Replacement fuse must have the same amperage and other specifications as the original.

Access to the fuses (see Figure 1-2) is provided by removing the top rear panel as explained in paragraph 4-4.

5. MECHANICAL CHECKS AND ADJUSTMENTS

5-1. Brake Mechanism

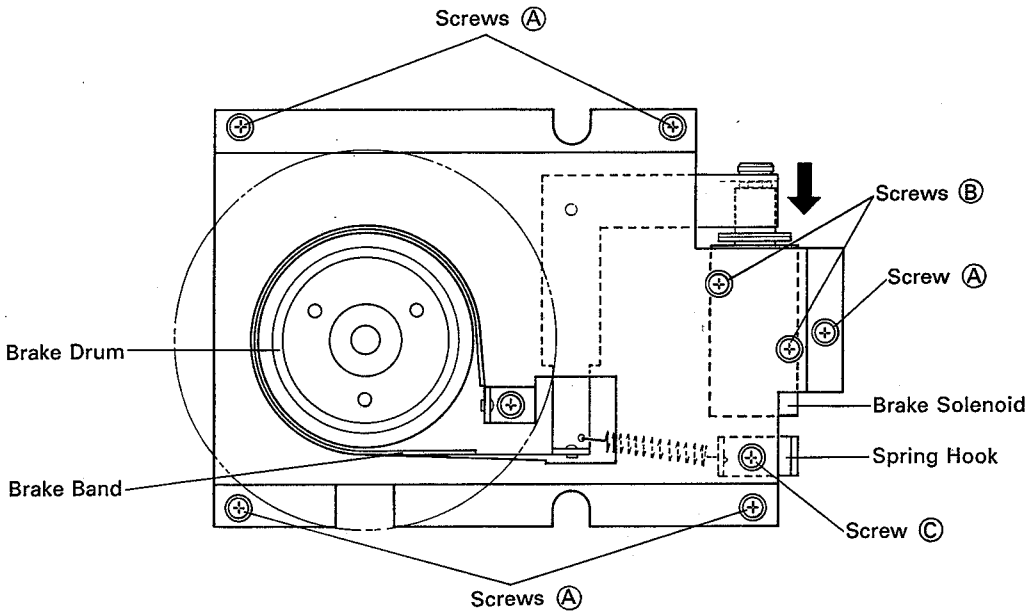


Figure 5-1. Brake Band-Drum Clearance Adjustment

Normally, the brake mechanism does not require to be checked and adjusted. However, if its mechanical parts or solenoids have been replaced, the following should be performed.

Refer to Figure 5-1.

1. Turn off power.
2. Remove both reel tables by removing three screws on each.
3. Move the brake solenoid plunger so it retracts and check for an even clearance between the brake drum and band. If necessary loosen five mount screws "A" and adjust the positioning of the brake assembly block for corrrect proper brake drum-band clearance.
4. Move the plunger and slightly turn the reel table, to visually check that the brake band does not contact the brake drum. Check both right and left brake assemblies.
   If the brake band touches the brake drum when you move the plunger and rotate the reel table, loosen screws "B" and move the solenoid until the brake band and drum do not make contact. Adjust the solenoid position so the brake band drum clearance is as tight as possible. Don't allow too a loose clearance between the brake band and drum.

5-2. Brake Torque

Brake torque needs to be adjusted when brake related parts such as brake felt, brake arm assembly, brake spring... have been replaced or whenever the following check procedure reveals "out of spec" torque.

The following check procedure is performed with reel stopped and in the direction in which brake torque is applied.

A. Check

1. Turn off power.
2. Refer to Figure 5-2. Connect string to reel hub and wind clockwise several times around the reel hub as shown. Then, attach a spring scale to the string.
3. Slowly pull the spring scale in direction shown and note the scale when the reading becomes steady. Repeat the measurement two or three times and calculate the mean value.
   The mean value of the scale readings should be within the following :

   1,600 to 1,800 g.cm

   Torque calculating formula : Torque (g.cm) = scale reading (g) x reel hub radius (cm)

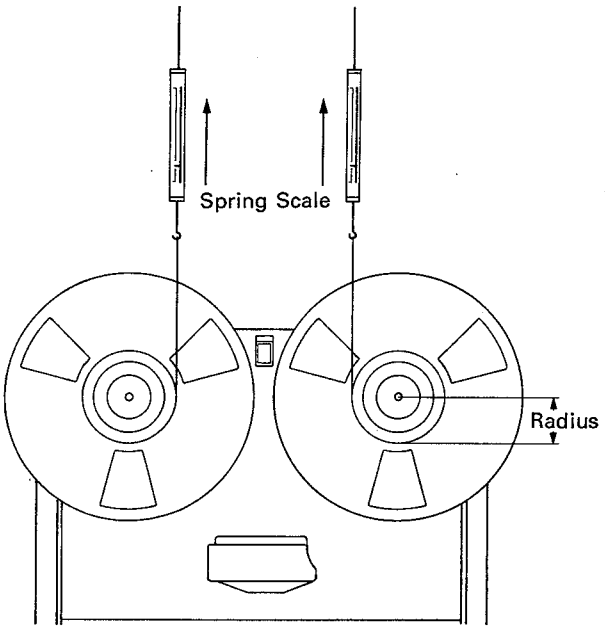


Figure 5-2. Brake Torque Measurement

B. Adjustment

1. Loosen screw "C" shown in Figure 5-2 and adjust the spring hook position.

2. Measure the torque again as explained above.

   If the measurement does not still meet specifications -

   Wipe off oily stains from the exterior of the brake drum using the appropriate cleaner, and replace the brake band felt with a new one.

5-3. Pinch Roller Pressure

A. Check

1. Block the right tension arm (shut-off arm) in its up/on position.

2. Attach a spring scale to the pinch roller shaft as shown in Figure 5-3.

3. Press PLAY and slowly pull the spring scale perpendicularly to the pinch roller arm as shown in Figure 5-3.

4. When the pinch roller loses contact with the capstan shaft and stops turning, slowly ease the spring scale and note the reading on the scale at the moment that the pinch roller starts again turning.

   Specifications : 1.5 to 1.7 kg

B. Adjustment

Loosen the three mounting screws (Figure 5-3) in the solenoid and adjust the solenoid position.

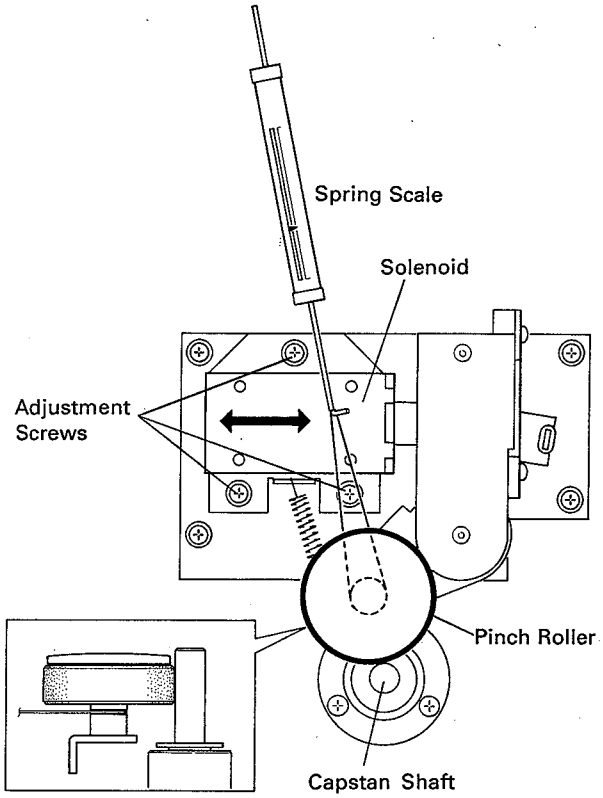


Figure 5-3. Pinch Roller Pressure Measurement and Adjustment

5-4. Capstan Shaft Tolerance

Refer to Figure 5-4 and check for a clearance of 0.1 to 0.2 mm as shown. If necessary, turn in or out the adjustment screw as shown.

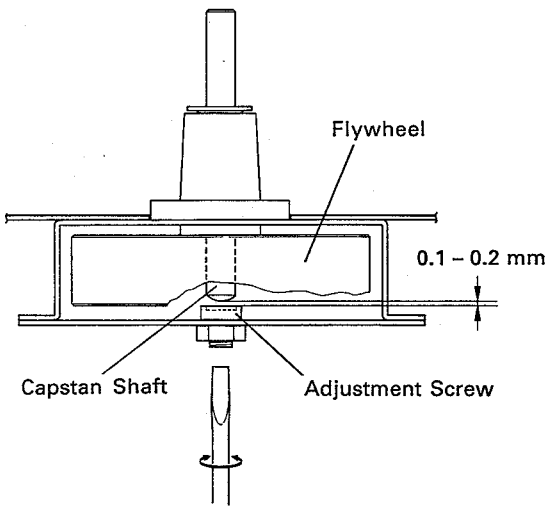


Figure 5-4. Capstan Shaft Tolerance Adjustment

5-5. Reel Table Height

The reel tables are each held to the reel motor shaft by two screws as shown in Figure 5-5.
Run tape in F.FWD and REW to check to see that the tape does not rub against both reels. If adjustment is necessary, loosen the two set screws and move the reel table in and out to adjust height.

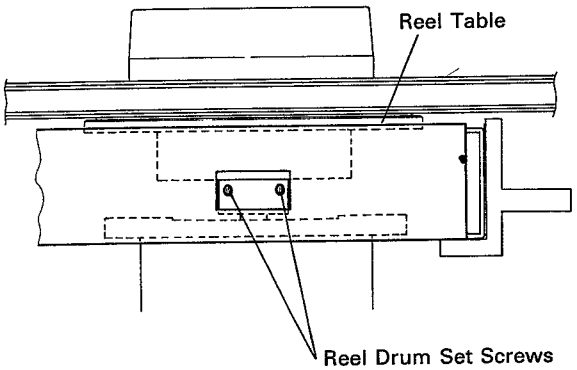


Figure 5-5. Reel Table Height Adjustment

5-6. Tape Tension Servo

Tape tension is constantly detected and controlled by the left and right tension sensor PCB assemblies inside the front panel. Both assemblies are identical in construction, each including a generator and two coils. Between the coils moves in and out an aluminum plate as tape tension varies and, accordingly, mutual inductance between the coils varies, so the tape tension arm movements are detected.

5-6-1. Tape Tension in Edit Mode

A. Check

1. Load a blank tape and wind until there is almost the same tape pack on both reels.

2. Enter EDIT mode, and, using a tentelometer T2-H20-M2, measure tape tension both at the supply (test point A) and the takeup (test point B) side (for test point locations, see Figure 5-6). Readings should be as follows :

   Specifications : 40 +/–5g, at both sides

   If necessary, proceed to the next procedure.

B. Adjustment

Locate the following resistors on the Control PCB (Figure 5-7) and adjust them.

R54 for the supply tape tension (T.T)
R53 for the takeup tape tension (B.T)

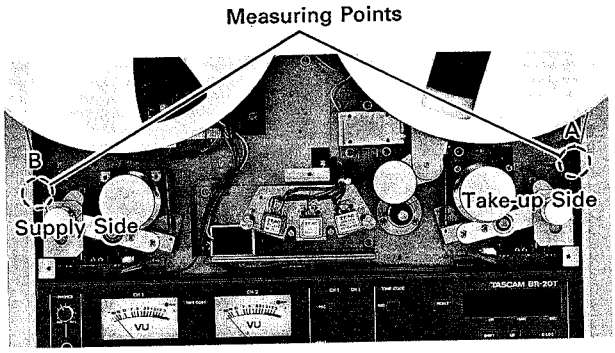


Figure 5-6. Tape Tension Measurement Points

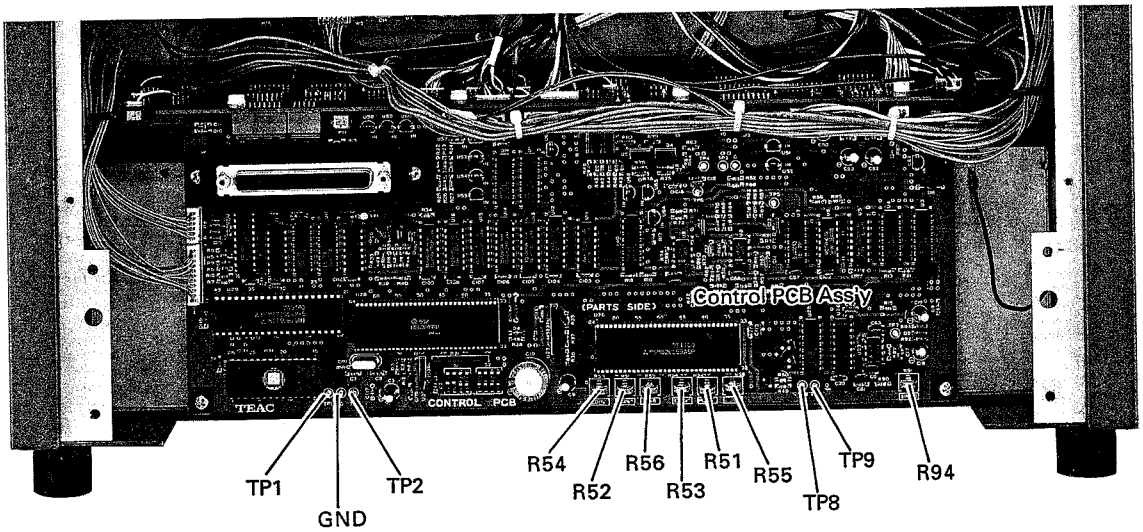


Figure 5-7. Tape Tension Adjustment Resistors

5-6-2. Play Tape Tension

A. Check

Run tape in PLAY and measure tape tension at A (takeup) and B (supply) test points shown in Figure 5-6.

Specifications : Supply side, 40 +/–5g
Takeup side, 50 +/–5g

B. Adjustment

Locate the following resistors on the Control PCB (Figure 5-7) and adjust them until tape tension is within specifications.

R52 for the supply side (T.T)
R51 for the takeup side (B.T)

5-6-3. Fast Forward/Rewind Tape Tension

A. Check

Short-circuit between TP-8 and TP-9 on the Control PCB (Figure 5-7), enter EDIT mode, and read the tentelometer at test points A (F.FWD, B.T) and B (REW, T.T) shown in Figure 5-6.

Specifications : 30 to 40 g at both test points

B. Adjustment

Locate the following resistors on the Control PCB (Figure 5-7) and adjust them until tension is within specifications.

R55 for F.FWD tension (B.T)
R56 for REW tension (B.T)

5-7. Tape Speed

Tape speed is measured using a wow/flutter test tape containing a 3000 Hz reference signal.

Tape speed is affected by pinch roller pressure, tape tension, etc.

5-7-1. "FIX" Tape Speed

A. Check

1. Connect a frequency counter to the OUTPUT connectors, and thread a test tape.
2. Set the SPEED MODE selector switch to FIX.
3. Run the tape in PLAY and read the frequency counter.
   Check both at HIGH and LOW speeds.

   Specifications : 3000 Hz +/-0.8%

B. Adjustment

1. Run the tape until both the left and right tape packs are almost the same, and adjust the following resistors on the Capstan Servo PCB (Figure 5-8) until the frequency counter reads 3000 Hz.

   R51 for HIGH speed
   R50 for LOW speed

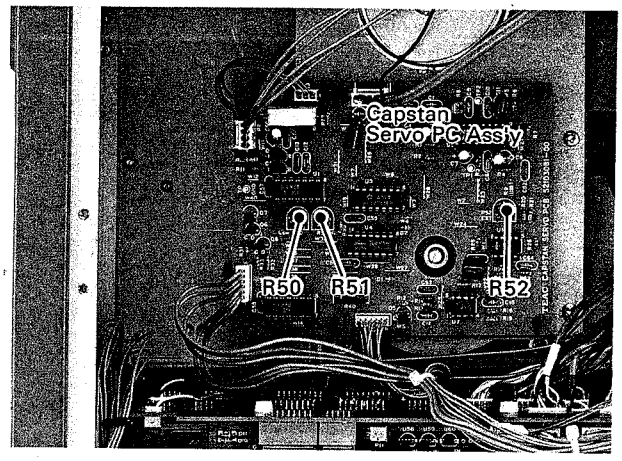


Figure 5-8. Tape Speed Adjustment Resistors

2. After the above adjustments, play the beginning (then the end) of the test tape, to check to see readings on the frequency counter are within specifications. If the readings don't meet the specifications, check Pinch Roller Pressure (paragraph 5-3) and Tape Tension (paragaph 5-6).

5-7-2. "EXT" Speed

A. Check

1. Use jumper wires to connect pin 13 of the ACCESSORY 1 connector to GND, and connect an external oscillator to pins 7 (Hot, High) and 14 (Cold, Low).
2. Play the test tape and check the frequency counter reads 3000 Hz when a 9.6 kHz pulse signal is fed into the recorder from the external oscillator.
3. Adjust the oscillator so it provides a 30 % (approx.) increment/decrement in its output frequency, to check to see tape speed varies proportionally.

B. Adjustment

Locate resistor R52 on the Capstan Servo PCB (Figure 5-8) and adjust that resistor for correct readings on the frequency counter.

5-8. Fast Winding Speeds

A. Check

1. Connect an oscilloscope between TP-1 and GND on the Control PCB (Figure 5-7).

2. Load a 10.5" reel tape, and run its mid point (approx.) to check that the TP-1 wave form shows 4.1 to 4.2 msec. cycle.

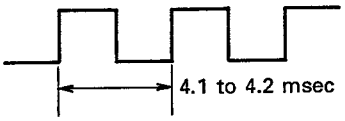


Figure 5-9. Fast Winding Speed Measurement

B. Adjustment

Adjust resistor R94 located on the Control PCB (Figure 5-7).

5-9. Wow and Flutter

Wow and flutter are effectuated by a complex, mutual influence of the transport-related various mechanical parts.

1. Connect a wow/flutter meter to the OUTPUT connectors, and load a tape speed test tape.

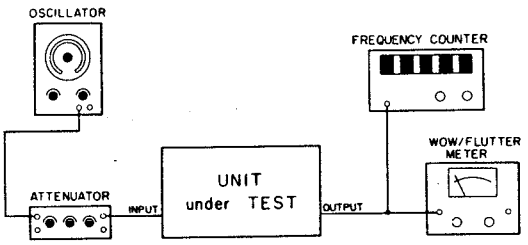


Figure 5-10. Wow/Flutter Test Connections

2. Make the following switch settings :

   PITCH CONTROL to FIX ;
   Output Source Selector Switch to REPRO.

3. Run the tape in PLAY and read the wow/flutter meter both at the beginning and the end of the tape.

   Specifications are as follows :

   DIN/IEC/ANSI (PEAK), Weighted (2 σ)
   HIGH : +/–0.06%
   LOW : +/–0.09%

5-10. Tape Positioning, Check and Fine Adjustment

Tape positioning is influenced by various parts of these : head assembly, tension arm, pinch roller, capstan motor, etc.
The center of each head serves as the reference for correct tape running height.

Tape positioning is checked by running tape in PLAY, F.FWD and REW, to see the tape runs at the head center height, without rubbing against any tape guide edge. Proceed as follows :

A. Check

1. Thoroughly clean the heads and tape path using a good cleaner.

2. Load a blank tape on the machine, run it in PLAY, and check the tape is running at the center height of each of the three heads (at the center of the core). Repeat the check in F.FWD and REW.

3. Check also the tape is running at the center of the left and right tension rollers.

B. Fine Adjustment

Tension roller height is adjusted by first loosening the set screw with a hexagonal wrench then moving the tension roller in and out (see Figure 5-12).

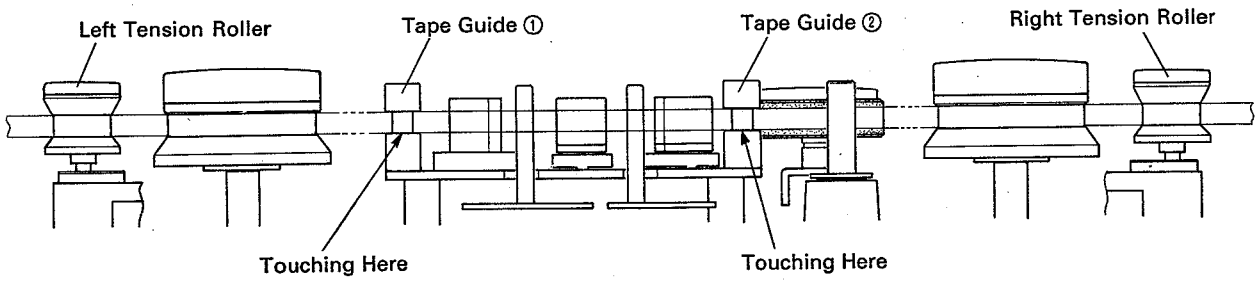


Figure 5-11. Tape Positioning

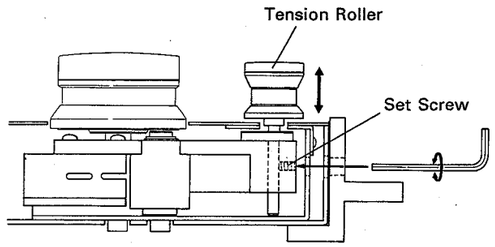


Figure 5-12. Tension Roller Height Adjustment

1. Run the tape in PLAY.
2. Refer to Figure 5-12 and adjust the height of the left and right tension rollers until the tape lower edge slightly contacts the lower flange of the tape guides "1" and "2" shown in Figure 5-11.

   Repeat adjustment by running the tape in F.FWD and REW as well.
3. After adjustments, retighten the lock screw.

NOTE : Tape running height adjustments significantly affect head-tape contact. After tape running height has been adjusted, be sure to recheck these : Head-to-tape contact, Head azimuth (see below).

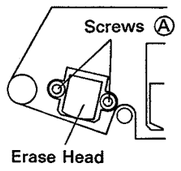
5-11. Head Alignment

5-11-1. Head-Tape Contact

A. Erase Head

The erase head requires only its tape contact adjustment and has no azimuth adjustment.

BR-20N, D



BR-20T

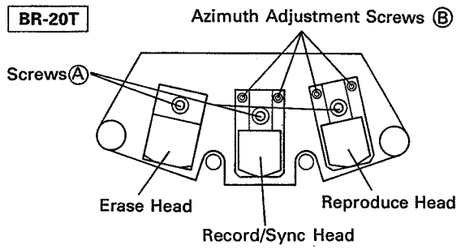


Figure 5-13. Head Adjustment Screws

The tape must contact the erase head so that the double gap is centered in the tape contact area. A poor tape contact appears as a poor erasure performance of the head.

If a poor tape contact is revealed (see 6-13, Erasure), perform the following :

1. While measuring erasure, run tape.
2. Loosen the "A" screw(s) shown in Figure 5-13, and, holding the upper area of the erase head, tilt left and right for best erasure, and retighten the "A" screw(s) to block the head where a maximum erasure is measured.
3. Recheck for best erasure.

NOTE : Erase head replacement entails the following re-adjustments :

- Bias tuning of all channels' R/P amplifiers.
- Record bias adjustment of all channels (this adjustment is not necessary for the gapless punch-in versions)

B. Record and Sync Repro Heads

Both heads are the same in characteristics. Check and adjustments are performed by reproducing a high frequency recording on a test tape (16 kHz recording), with the Output Source Selector switch set to REPRO for the reproduce head check and adjustment, and to SYNC for the rec/sync head check and adjustment. The tracks' REC switches must be set to OFF.

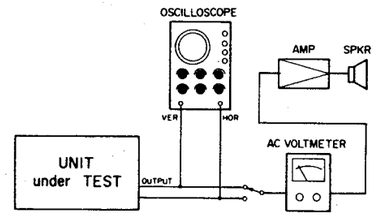


Figure 5-14. Head Alignment Test Connections

1. Connect an AC level meter to the OUTPUT connector of both channels as shown in Figure 5-14.
2. Load a frequency response test tape (YTT-1004) and reproduce its 16 kHz recording at HIGH speed.
3. Watching the output level of both channels, manually apply a slight back tension to the left reel.

   If the head correctly contacts the tape, the output level must not vary when you push the reel. If the level readings increase, it shows a poor tape contact. Then, proceed to the following:
4. Refer to Figure 5-13. Loosen tape contact adjustment screw "A" and azimuth adjustment screws "B" on the head being checked.
5. Reproduce the test tape, and tilt left and right the head for highest output level, as in step 2 under paragraph 5-11-1 above.
6. Block the head where best output level is read by retightening screw "A".
7. After adjustment of head-tape contact, proceed to the following procedure to adjust azimuth.

NOTE : Be sure to perform head azimuth adjustment whenever tape contact is adjusted.

5-11-2. Head Azimuth

There is no azimuth adjustment for the erase head ; adjustment is for the reproduce and the rec/sync head only.

Check and adjustments are done by reproducing a high frequency recording on the test tape (16 kHz recording). For the reproduce head, the Output Source Selector switch is to set to REPRO, and, for the rec/sync head, to SYNC. The track REC switches must be set to OFF.

1. As shown in Figure 5-14, connect the channel 1 output to the vertical input of the oscilloscope, and the channel 2 output to the horizontal input of the scope. Also connect an AC level meter to measure the channels' output levels.
2. Load a test tape on the machine, and reproduce the 400 Hz then the 16 kHz recording on the test tape at HIGH speed.
   While doing so perform the next step.
3. Adjust the azimuth adjustment screws for a phase difference of 90 degrees or less between both channel outputs (refer to Figure 5-15) and, at the same time, for highest output level readings (from both channels).

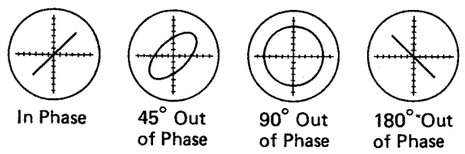


Figure 5-15. Phase Difference Between Both Channels

NOTE : If the vertical and horizontal input connections to the scope are reversed, the phase also is.

- To adjust the azimuth adjustment screws "B" shown in Figure 5-13, note the following;

Slightly loosen one of the "B" screws and tighten the other, inch by inch (in step 3 above), and when an optimum azimuth is obtained, tighten the two screws paying attention not to undo the adjustment as monitored by the scope.

6. AMPLIFIER CHECKS AND ADJUSTMENTS

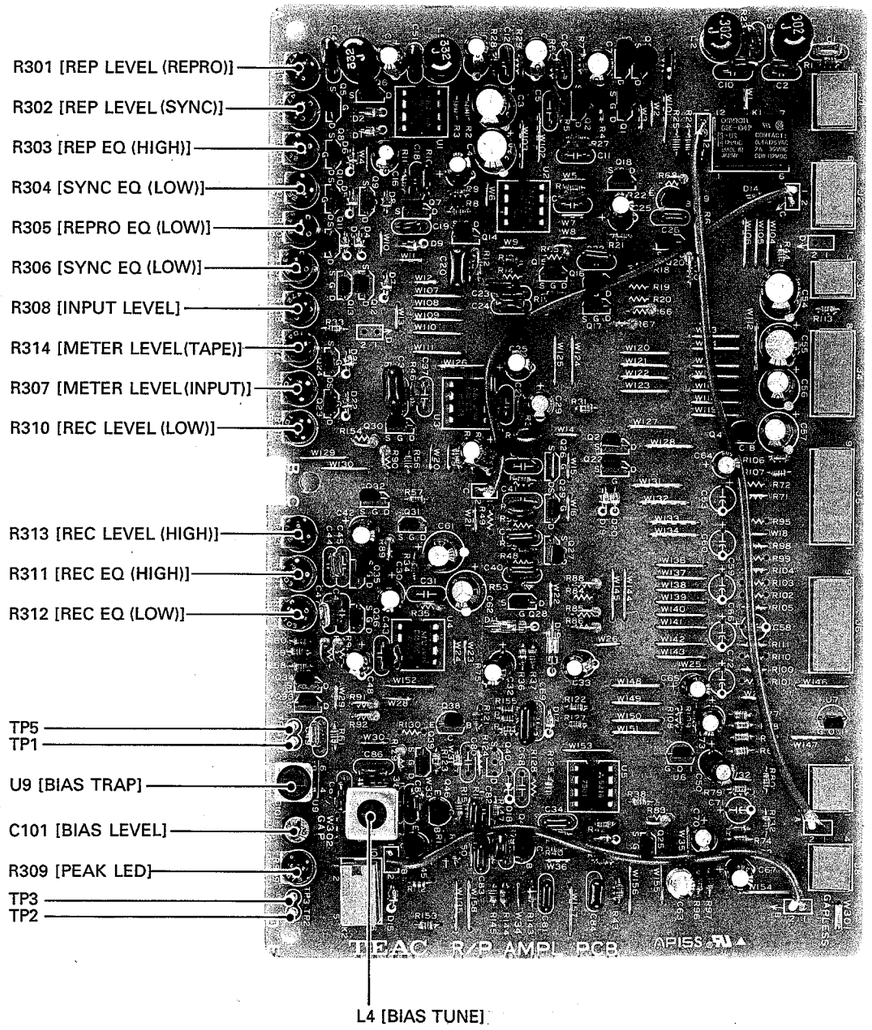


Figure 6-1. Amplifier Adjustments

6-1. Preliminary Notes

6-1-1. Nominal Input/Output Levels

In the following, we use the XLR type input and output connectors whose nominal output and input levels are +4 dBm (1.23 V).

The output level remains the same even if the XLR type input is made unbalanced, with a jumper wire connected between pin 1 (ground) and pin 2 (cold, low) or 3 (hot, high).

In addition, the RCA jacks has a nominal level of –10 dBV (0.3 V).

6-1-2. Level Controls

Although the input and output levels can be controlled by the INPUT and OUTPUT knobs, all checks and adjustments are made (unless otherwise noted) with the INPUT and OUTPUT CAL/UNCAL switches set to CAL.

6-1-3. Others

- Perform each check (and adjustment if necessary) for channel 1 first; then repeat the procedure for channel 2.

- Be sure to turn power off when replacing the REC/REPRO PCB assembly or any other electrical parts.

6-2. Input Level

Adjustment is made for nominal output level when nominal input signal is fed into the INPUT connectors.

A. Check

1. Connect test equipment as shown in Figure 6-2.

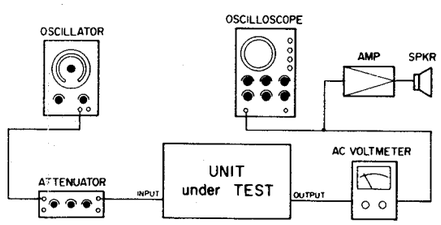


Figure 6-2. Level and Frequency Response Test Connections

2. Connect a 1 kHz, +4 dBm (1.23 V) signal to the INPUT XLR type connectors.

3. Set the Output Source Selector switch to INPUT.

4. Check for +4 dBm (1.23 V) at the OUTPUT connectors. If necessary, proceed to the next step.

B. Adjustment

Adjust resistor R308 for +4 dBm output.

6-3. VU Meters

The VU meters must read "0 VU" when fed with the nominal level input (6-2 above) and with the nominal level output (6-5 below).

A. Check

1. When the nominal input level of +4 dBm (step 4, paragraph 6-2 above) is coming into the machine, check to see the VU meters read "0 VU".

2. Check to see the VU meters read "0 VU" when a reference test tape is reproduced (step 3, paragraph 6-5 below).

   NOTE : When the test tape YTT-1003 (7-1/2 inch/s, 185 nWb/m) is used — ;

   The reading must be :

   –2.6 VU for the REF LEVEL of 250 nWb/m.
   –3.9 VU for the REF LEVEL of 320 nWb/m.

B. Adjustment

Adjust the following resistors :

R307 for the input level reading
R314 for the output level reading.

6-4. Peak LED

The peak LED is designed to light up at +12 VU for 250 nWb/m and at +10 VU for 320 nWb/m.

A. Check

With the same conditions as in paragraph 6-2 above, switch the REF LEVEL to LOW, and check the peak LED lights when the input level is increased until the VU meters read the values specified above and turns off when decreased by 1 dB.

B. Adjustment

Use resistor R309.

6-5. Reproduce Level

Reproduce level is checked by reproducing a reference record level NAB 250 nWb/m or 320 nWb/m.

A. Check

1. Connect an AC level meter and an oscilloscope to the rear OUTPUT XLR type connectors.

2. Make the following switch settings :

   INPUT and OUTPUT CAL/UNCAL Switches to CAL;

Output Source Selector Switch to REPRO;
REF LEVEL Switch to LOW;
SPEED switch to LOW;
EQ switch to NAB.

3. Reproduce the reference level recording on the test tape and check for nominal output level reading.

   NOTE : When the test tape YTT-1003 (7-1/2 inch/s, 185 nWb/m) is used — ;

   - The output level drops by 2.6 dB from the nominal level (+4 dBm) when REF LEVEL is at 250 nWb/m.
   - The output level drops by 3.9 dB from the nominal level (+4 dBm) when REF LEVEL is at 320 nWb/m.

4. Set the Output Source Selector switch to SYNC, and repeat the above procedure.

B. Adjustment

Use the following resistors :

R301 for REPRO
R302 for SYNC

6-6. Reproduce Frequency Response

A. Check

At HIGH tape speed

1. Make the following switch settings :

   INPUT and OUTPUT CAL/UNCAL switches to CAL;
   Output Source Selector Switch to REPRO;
   SPEED switch to HIGH;
   EQ switch to NAB, IEC.

2. Reproduce the test tape, and check the output level readings meet specifications for each of the frequencies specified in Figure 6-3.

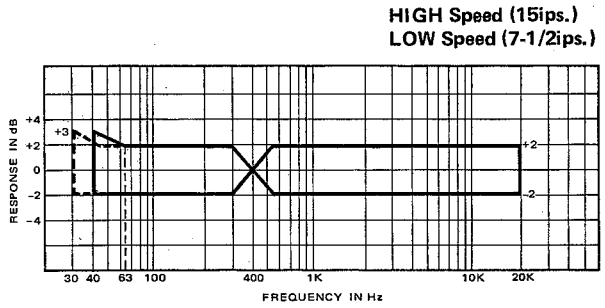


Figure 6-3. Reproduce Frequency Response

Output level from the 400 Hz recording serves as the reference. (See Figure 6-3 for specifications.)

NOTE : Use the test tape YTT-1004 (15 inch/s) when the EQ switch is set to NAB ; and the test tape YTT-1064 (15 inch/s) when the EQ switch is set to IEC.

3. Switch the output source selector from REPRO to SYNC, and repeat step 2. Specifications are the same as in step 2.

At LOW tape speed

4. Switch the SPEED switch from HIGH to LOW.

5. Reproduce the test tape, and check the output level readings are within specifications. See Figure 6-3 for specifications.

   NOTE : Use test tape YTT-1003 (7-1/2 inch/s) when the EQ switch is set to NAB ; and YTT-1063 (7-1/2 inch/s) when the EQ is at IEC.

6. Switch the output source selector switch from REPRO to SYNC, and read the output levels as in step 5 above. Specifications are the same as in step 5.

B. Adjustment

Tape Speed	Adjustment REPRO	SYNC	Adjust so that :
HIGH	R303	R304	Level at 16 kHz becomes the same as at 400 Hz.
LOW	R305	R306	Level at 16 kHz becomes the same as at 400 Hz.

If specifications are not met, check the following :

- Cleanness of the heads, correct head-tape contact
- If only either channel is out of specs, replace or repair the REC/REPRO AMP PCB of that channel.
- If both channels are out of specs, check the aging of the test tape being used, the correct power connection, etc.
- As a final measure, replace the head assembly.

6-7. Bias Tuning and Bias Trap Adjustment

Bias tuning refers to a tuning of the bias driver amplifier against the master bias signal.

Bias trap refers to a trap adjustment of the bias signal in the record amplifier.

Bias tuning and bias trap adjustment have correctly been achieved before shipment, and are necessary to be repeated only when the following are replaced :

- REC/SYNC head, or ERASE head
- Bias oscillator

6-7-1. Bias Tuning (L4)

Preliminary Notes :

- In the following, don't allow the voltmeter to show maximum reading, which overloads the bias drive amplifier, causing damage to it.
- Use a non-inductive screwdriver (plastic or wooden).

1. Connect a DC voltmeter between TP-3 (HOT) and TP-2 (COLD) on the R/P AMP PCB.
2. Engage the REC enable switch of both channels and put the transport into Record mode.
3. Adjust L4 for minimum reading on the voltmeter. Reading you could achieve must be about 0.2 V.

   NOTE : After adjustment of L4, wait for about 1 minute and check to see the reading remains the same.
4. (For the gapless punch-in models only) Connect the DC voltmeter between TP-1 (CH 1)/TP-2 (CH 2) on the AMP CONT PCB (Figure 6-4) and TP-2 on the R/P AMP PCB.
   Then, adjust L101 (CH 1)/L201 (CH 2) for minimum reading on the voltmeter.

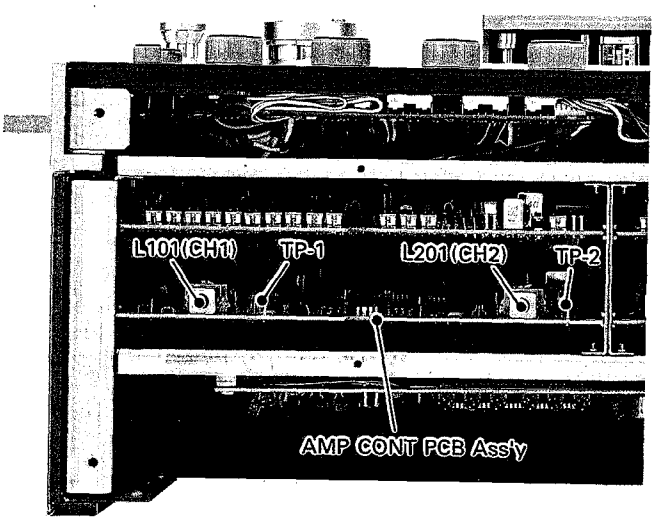


Figure 6-4. Test Points on AMP CONT PCB

6-7-2. Bias Trap Adjustment (U9)

1. Connect an AC level meter between TP-1 and TP-5 (GND) on the R/P AMP PCB of the channel to be tested.
2. Make the following switch settings :

   Track REC switch to ON (both channels);
   UNCAL/CAL switch to CAL (both INPUT and OUTPUT).
3. Put the transport into Record mode.
4. Increase the sensitivity of the AC level meter and adjust the trap coil U9 of the channel being tested for minimum reading on the level meter.

6-8. Record Bias

Record bias *must* be adjusted *after* the bias tuning and bias trap adjustment (see above).

Perform the following procedure when —

- It is necessary to fine adjust record bias to suit the type of tape being used for actual recording.
- The following have been replaced :

  REC/SYNC head or ERASE head

  Rec/repro amplifier, bias drive amplifier, master bias unit

When preforming record bias adjustment, understant this : record bias has a significant effect on the high frequency response and distortion, and on the record level too.

Adjustment is done for 6.5–7.5 dB below the peak level at 10 kHz to ensure minimum distortion and optimum output level.

1. Connect test equipment to the inputs and outputs of the machine as shown in Figure 6-2.
2. Make the following switch settings :

   CAL/UNCAL switch to CAL (both INPUT and OUTPUT);
   Monitor Source Selector switch to REPRO;
   SPEED switch to LOW;
   Track REC switch to ON (both channels).
3. Apply a 10 kHz, –6 dBm (388 mV, –10 VU) input signal and start recording it on a blank tape.
4. While the recording is taking place, perform the following :

   Refer to Figure 6-5. Slowly turn trim capacitor C101 clockwise until the level on the AC level meter connected to the outputs rises to a peak. Two peaks may be observable. When the second peak occurs, continue rotating C101 in a clockwise direction until reading decreases by 6.5–7.5 dB from the second peak level.

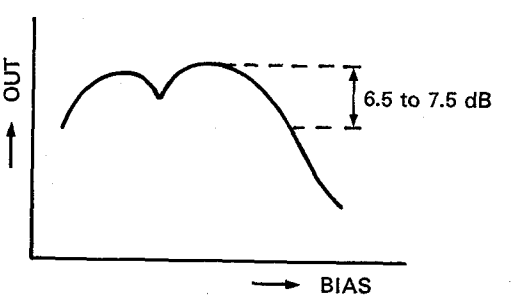


Figure 6-5. Bias Setting Adjustment

6-9. Record Level

Record level is adjusted so the nominal input level of +4 dBm causes the VU meters to read "0 VU."

The following procedure must be performed AFTER these have been adjusted : Reproduce level, Reproduce Frequency Response, Bias Tuning, Bias Trap, and Record Bias.

A. Check

1. Connect test equipment to the inputs and outputs of the machine as shown in Figure 6-2.

2. Make the following switch settings :

   UNCAL/CAL switch to CAL (both INPUT and OUTPUT);
   Monitor Source Selector switch to REPRO;
   SPEED switch to LOW;
   Track REC switch to ON (both channels).

3. Apply a 1 kHz, +4 dBm (1.23 V) signal to the inputs and record it on a blank tape.

4. While the recording is taking place, check to see the AC level meter reads +4 dBm and the VU meters read 0 VU.

5. Similarly, set SPEED to HIGH and repeat the check.

B. Adjustment

NOTE : Adjustment must first be done at LOW, then at HIGH.

Adjust resistors R310 (for LOW SPEED) and R313 (for HIGH SPEED).

As for the VU meter adjustment, see paragraph 6-3.

6-10. Overall Frequency Response

Overall frequency response affects the record bias and must be rechecked if bias adjustments (paragraphs 6-7, and 6-8) are performed.

A. Check

1. Connect test equipment as shown in Figure 6-2.

<u>At HIGH SPEED</u>

2. Apply a +4 dBm (1.23 V, 0 VU) signal to the XLR type INPUT of the channel being tested.

3. Make the following switch settings :

   REF LEVEL switch to LOW;
   UNCAL/CAL switch to CAL (both INPUT and OUTPUT);
   Monitor Source Selector switch to REPRO;
   SPEED switch to HIGH;
   Track REC switch to ON (both channels).

4. Load a blank tape, enter Record mode and sweep the input signal frequency over the range 40 Hz to 22 kHz. While doing so, watch the voltmeter and check that the frequency response is within the tolerance specified in Figure 6-6.

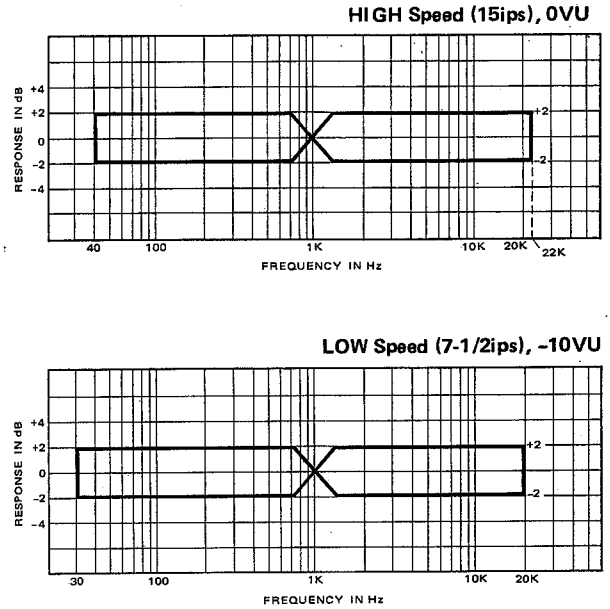


Figure 6-6. Overall Frequency Response

5. In a similar way, check frequency response for Sync Reproduce ; set the Monitor Source to SYNC and play the recording again from the beginning.

<u>At LOW SPEED</u>

6. Change the input signal level to –6 dBm (388 mV, –10 VU).

7. Set the SPEED switch to LOW.

8. Put the deck into record mode and sweep the input signal frequency over the range 30 Hz to 20 kHz. Rewind the tape, play the recording, watch the voltmeter and check that the frequency response is within the tolerance specified in Figure 6-6.

9. Repeat check with the Monitor Source switch set to SYNC.

B. Adjustment

If adjustment is necessary, proceed as follows :

1. Record bias check

   Is record bias set as specified under paragraph 6-8? If it is, adjust the record equalizer as follows:

2. Record equalizer adjustment

At HIGH SPEED :

While recording a –6 dBm (388 mV, –10 VU), 22 kHz signal, adjust R311 for the same output level as at 1 kHz.
After adjustment, repeat check A above.

At LOW SPEED :

While recording a –16 dBm (123 mV, –20 VU), 20 kHz, adjust R312 for the same level as at 1 kHz.
After adjustment, repeat check A above.

6-11. Overall Distortion

Overall distortion is checked by recording a nominal level signal and reproducing it. Use an oscillator whose distortion is less than 0.1%

1. Connect test equipment as shown in Figure 6-7 to the inputs and outputs of the machine.

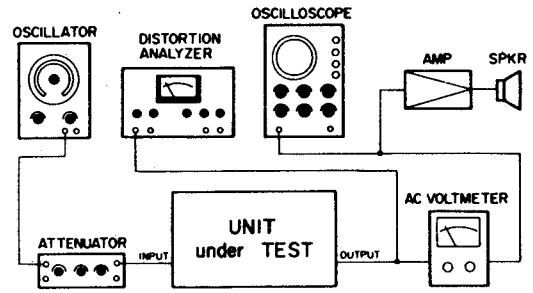


Figure 6-7. Distortion Test Connections

2. Connect a 1 kHz, –6 dBm (1.23 V) signal to the XLR type INPUT connector to be checked.

3. Make the following switch settings :

   UNCAL/CAL switch to CAL (both INPUT and OUTPUT);
   Monitor Source Selector switch to REPRO;
   SPEED switch to HIGH;
   Track REC switch to ON.

4. Record the input signal on a blank tape.

5. Rewind the tape, play the recording and read the output on the distortion meter. Distortion should be 0.8% or less.

6. Set the SPEED switch to LOW and repeat the above procedure to check for distortion of 0.8% or less as at HIGH speed.

7. If distortion does not meet specifications, proceed as follows :

   - If only either channel is out of specs, check -

     1. Record bias, and
     2. Rec/repro amplifier

   - If both channels are out of specs, perform the following :

     1. Head demagnetization, and
     2. +B power supply check

   - As a final measure, replace the record head.

6-12. Overall Signal-To-Noise Ratio

Signal-to-noise ratio is checked by recording the nominal level signal of 4 dBm, 1 kHz and reproducing the recording to read the output level. This reading serves as a reference with which is compared the output level read when a no-signal recording is played back.

NOTE : Before performing the following procedure, be sure to demagnetize the entire tape path.

1. Connect test equipment to the inputs and outputs of the machine as shown in Figure 6-2.

   Insert a 20 Hz-20 kHz band pass filter between the XLR type OUTPUT connector under test and the AC level meter.

2. Make the following switch settings :

   UNCAL/CAL switch to CAL (both INPUT and OUTPUT);
   Monitor Source Selector switch to REPRO;
   SPEED switch to HIGH;
   Track REC switch to ON.

3. Record the nominal signal of 1 kHz, +4 dBm (1.23 V), then, switch the INPUT UNCAL/CAL switch to UNCAL, turn the INPUT level control all the way to the left (to minimum), and record again.

4. Rewind the tape to the beginning of the recording, play the tape and read on the AC level meter the output level of both the "signal" and "no-signal" recordings. The level difference between the two recordings should be 50 dB or more.

5. Set the SPEED switch to LOW and repeat procedure to check for signal-to-noise ratio of 50 dB or more as at HIGH speed.

6. If adjustment is necessary, proceed as follows :

   — If only either channel is out of specs, check (and adjust if necessary) the following :

     - Record equalizer
     - Repro equalizer

   — If both channels are out of specs, check the following:

     - +B power supply
     - Head demagnetization
     - Erasure

   — If there is no problem in the machine, use a new blank tape to measure again signal-to-noise.

6-13. Erasure

The tape used for this test should be bulk erased. Any residual signal may affect the measurement.

1. Connect test equipment to the input and output of the channel being tested as shown in Figure 6-8.

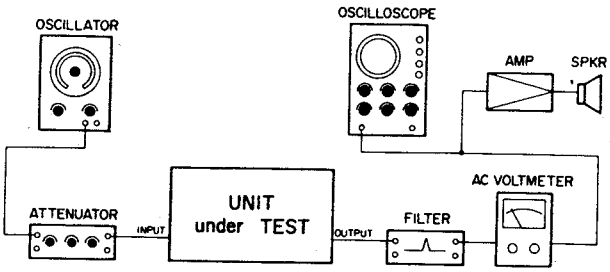


Figure 6-8. Erasure Test Connections

Insert a 1 kHz band pass filter between the OUTPUT
connector and the AC level meter.

2. Make the following switch settings :

   REF LEVEL switch to LOW;
   UNCAL/CAL switch to CAL (both INPUT and OUTPUT);
   Monitor Source Selector switch to REPRO;
   Track REC switch to ON (only the switch of the channel under test).

3. Record a 1 kHz, +14 dBm (3.88 V) (i.e., 10 dB higher than the nominal +4 dBm).

4. Disconnect the oscillator.

5. Rewind the tape to about half way through the recorded portion of the tape, and enter again Record mode to erase the tape by recording through the previously recorded section with no input signal.

6. Rewind the tape all the way back to the beginning of the recording, and play the tape to compare the level on the AC level meter from the original 1 kHz signal recording with the level from the "no-signal" recording. The level difference should be 70 dB or more.

7. If adjustment is necessary, perform the following :

   - Clean the erase head
   - Check the erase head alignment
   - Check bias tuning

6-14. Headphones Output Level

1. Connect to the PHONES jack an 8-ohm load, AC level meter, and oscilloscope.

2. Set the Monitor Source Selector switch to INPUT and apply a 1 kHz, +4 dBm (1.23 V) signal to both CH 1 and CH 2 INPUTs.

3. Turn the headphone level control to maximum, and check the AC level meter reads 1.2 V +/–2dB.

6-15. Crosstalk

1. Connect an oscillator to the INPUT of the channel which is not under test, and connect a 1 kHz band filter and AC level meter to the OUTPUT of the channel under test.

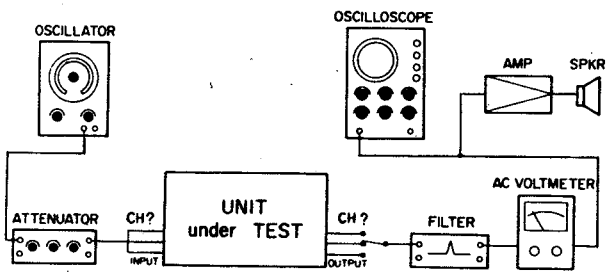


Figure 6-9. Crosstalk Test Connections

2. Load a blank tape on the machine, and make the following switch settings :

   Monitor Source Selector switch to REPRO;
   Track REC switch to ON (both CH 1 and CH 2).

3. Apply the nominal 1 kHz, +4 dBm (1.23 V) signal to the INPUT for the channel adjacent to the channel being tested and put the machine into Record mode. Rewind the tape and play the recording.

4. Measure the output of the channel being tested to get a level reference, then measure the output of the channel through which "no signal" was recorded.

   The difference between the two channels should be 60 dB or greater on NAB and TC models and 55 dB or greater on DIN models.

5. Rewind again the tape to the beginning of the recording.

6. Switch the monitor source from REPRO to SYNC.

7. Play the tape, and measure the output of both channels as in step 4 above.

   The difference between the two channels should be 60 dB or greater on NAB and TC models and 55 dB or greater on DIN models.

6-16. Time Code Channel Adjustments (BR-20T only)

The following adjustments have been achieved before shipment and need to be performed only when — ;

- Rec/sync and/or Record heads are replaced.
- Time code amplifier is replaced.
- An error occurred in the time code recording and/or reproducing.

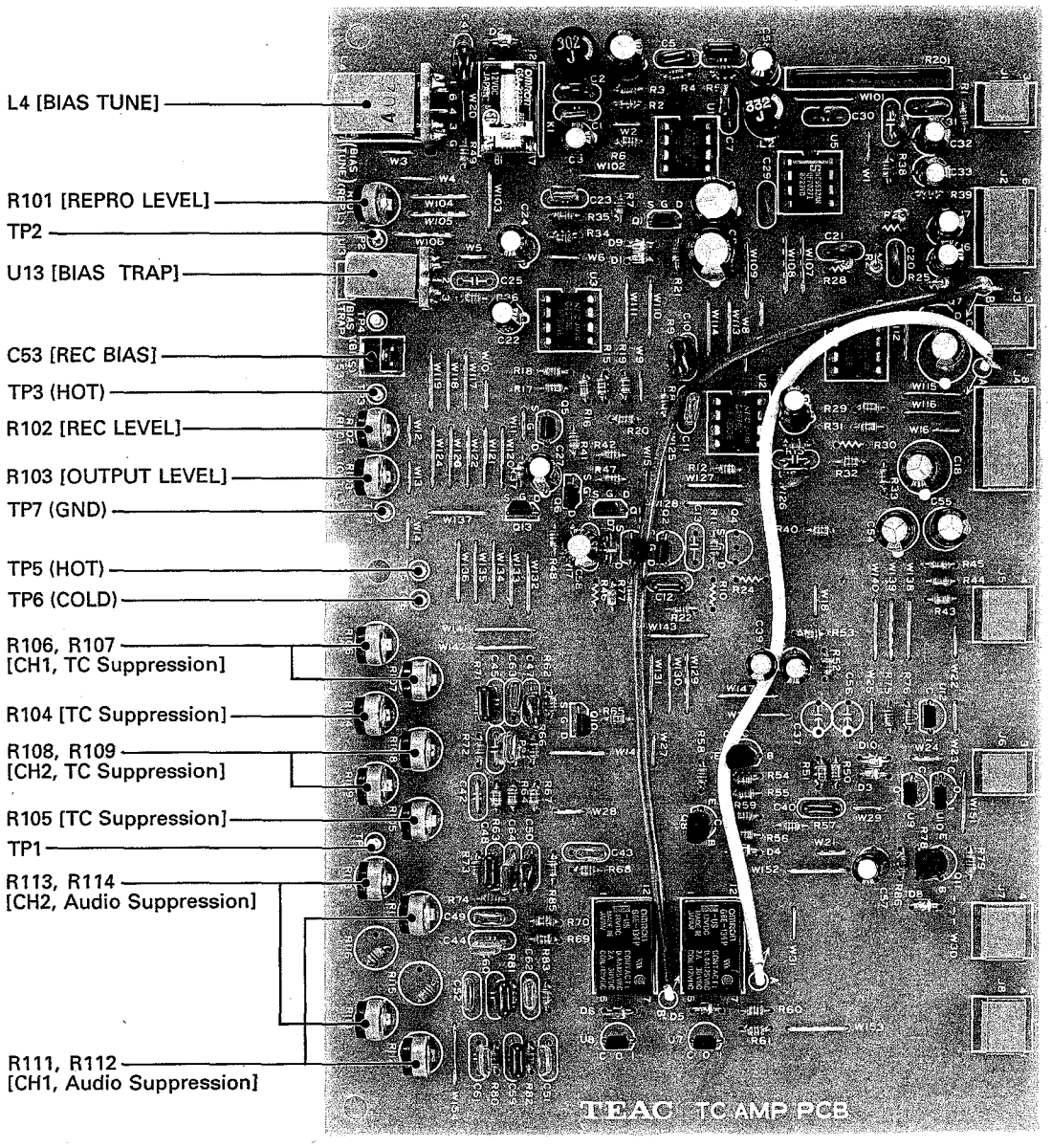


Figure 6-10. Time Code Amplifier Adjustments

6-16-1. Reproduce Level Set

1. Set the REF LEVEL switch to LOW, and the SPEED switch, to LOW.

2. Play a test tape recorded with a nominal level signal.

3. Adjust R101 on the Time Code Amp PCB for 6V p-p (–6.8 dBV) at TP-2 on the PCB.

   NOTE : When the YTT-1003 test tape (7-1/2 ips, 185 nWb/m) is used, the level at TP-2 decreases by — ;

   2.6 dB at 250 nWb/m of REF LEVEL
   3.9 dB at 320 nWb/m of REF LEVEL

6-16-2. Output Level

With the same conditions as in 6-16-1 above, adjust R103 on the Time Code Amp PCB for 2V p-p at the XLR type connector for the TIME CODE OUTPUT.

6-16-3. Bias Tuning (L4)

Preliminary Notes :

- In the following, don't allow the voltmeter to show maximum reading, which overloads the bias drive amplifier, causing damage to it.

- Use a non-inductive screwdriver (plastic or wooden).

1. Connect a DC voltmeter between TP-5 (HOT) and TP-6 (COLD) on the Time Code Amp PCB.

2. Engage the TIME CODE REC switch and put the machine into Record mode .

3. Adjust L4 on the Time Code Amp PCB for minimum reading on the voltmeter. That should be about 0.7 V.

   NOTE : After adjustment of L4, leave the machine for about 1 minute to check to see no variation in the reading on the voltmeter.

6-16-4. Bias Trap (U13)

1. Connect an AC level meter between TP-3 (HOT) and TP-7 (GND) on the Time Code Amp PCB.

2. Engage the TIME CODE REC switch and put the machine into Record mode.

3. Adjust U13 on the Time Code Amp PCB for minimum reading on the AC level meter.

6-16-5. Input Level

1. Connect a square wave oscillator to the INPUT for the TIME CODE channel and an oscilloscope to its OUTPUT.

2. Engage the TIME CODE REC switch and put the machine into Record mode.

3. Watch the scope and adjust the oscillator so its output (2 kHz) varies over the range from 0.3 V p-p to 6 V p-p, to check to see a display of 2 V p-p (+/–0.5 V p-p) on the scope does not vary.

6-16-6. Record Bias

1. Connect an AC level meter between TP-1 and TP-7 (GND) on the Time Code Amp PCB.

2. With no signal connected to the INPUT for the time code channel, adjust C53 on the Time Code Amp PCB for 20 mV (2 mA) on the AC level meter.

6-16-7. Record Level

With the same conditions as in 6-16-5 above, record square wave signal from the oscillator on the time code track, rewind the tape and play the recording. Check for 6 V p-p +/–0.5 V at TP-2 on the Time Code Amp PCB. If out of specs, adjust R102 on the Time Code Amp PCB.

6-16-8. Crosstalk Suppression

I. Time Code Signal Leakage (Both Time Code and Audio Channels in Reproduce Mode)

1. Connect an AC level meter to the OUTPUT for either audio channel (CH1 or CH 2). Or, you could connect headphones to the PHONES jack. Set the Monitor Source Selector switch to SYNC.

2. Record time code on the time code track.

3. Rewind the tape, play the recording in SYNC (the audio tracks should not contain any recording), and adjust R104 on the Time Code Amp PCB for minimum reading on the AC level meter or, if you are using headphones, until the audio track output melts into the tape hiss or only faintly distinctive from the hiss.

II. Time Code Signal Leakage (Both Time Code and Audio Channels in Rec/Repro mode)

1. As in I above, connect an AC level meter or headphones, and set the Monitor Source Selector switch to REPRO.

2. Record time code on the time code track and "no signal" on the audio track. While the recording is taking place, slowly turn R105 from the leftmost position in a clockwise direction until minimum leakage is read on the AC level meter or heard in the headphones, then slightly turn R105 back. Stop R105 where the same output level as in I above is obtained.

3. Rewind the tape, switch the monitor source to SYNC and play again the recording, to check to see the same output level as in I above. If not, repeat step 2.

III. Time Code Signal Leakage (Time Code Channel In Record and Audio Channel in Repro mode)

1. As in I above, connect the AC level meter or headphones.

2. Record time code on the time code track while reproducing an audio track in SYNC.

3. Adjust R106 and R107 (for CH 1) and R108 and R109 (for CH 2) on the Time Code Amp PCB for minimum leakage.

   Adjust each pair of resistors above, alternately, several times.

IV. Audio Signal Leakage (Time Code Channel in Reproduce and Audio Channel in Record)

Adjustment is repeated for each channel until minimum leakage level is read at TP-2 on the Time Code Amp PCB over the whole frequency range (100 Hz to 20 kHz).

1. Make the following switch settings :

   TAPE SPEED to LOW;
   Monitor Source Selector switch to INPUT;
   Audio Track REC switch to ON;
   Time Code Track REC switch to OFF.

2. Record a 0 VU signal on an audio track, and adjust semi-fixed resistors several times as explained below, until signal whose characteristics are shown in Figure 6-11 appears at TP-2 on the Time Code Amp PCB.

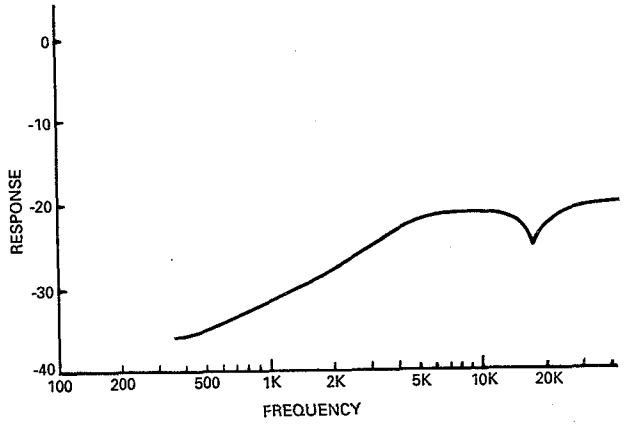


Figure 6-11. Crosstalk from Audio to Time Code Channels

As shown in the figure, TP-2 signal should present a slow upward curve starting from 1 kHz then a short downward curve bottomed out at 15 kHz point.

Adjustment Procedure

1. Suppose the level at TP-2 obtained under the same conditions as in 6-16-1 above to be 0 dB.

2. Change the audio signal frequency to 1 kHz and adjust R111 and R112 for CH 1 and R113 and R114 for CH 2 for - 20 dB or less at TP-2.

3. While sweeping the audio signal frequency over the range 1 kHz to 15 kHz, adjust R111 for CH 1 and R113 for CH 2 for -20 dB or less at TP-2.

4. Change the audio signal frequency to 15 kHz and adjust R111 for CH 1 and R113 for CH 2 for around -24 dB at TP-2.

5. After adjustments, recheck the TP-2 level for the following :

   –30 dB or less (approx.) for 1 kHz
   –20 dB or less (approx.) for 1 kHz–15 kHz
   Around –25 dB for 15 kHz

CHECKS AND ADJUSTMENTS CHART (1/2)

AD-JUST MENT	WHAT IS IT CALLED	SIGNAL SOURCE AND AMOUNT	WHAT TEST GEAR TO USE	WHAT IS THE RECORDER DOING	POINT TO ADJUST	WHAT READING TO ADJUST FOR
1	Reproduce Head Alignment	Reproduce head alignment test tape	VTVM and oscilloscope with channel 1 out to vertical in and channel 2 out to horizontal in	Reproduce at 15 ips, Output Selector at REPRO	Repro head alignment adjustment screws	Maximum output, less than 90° out of phase between both channels (at 16 kHz)
2	Record/Sync Head Alignment	Same as above	Same as above	Reproduce at 15 ips, Output Selector at SYNC	Record/sync head alignment adjustment screws	Same as above
3	Input Level	1 kHz, +4 dBm signal from oscillator connected to INPUT	VTVM connected to OUTPUT	Stop mode, Output Selector at INPUT	R308	+4 dBm (1.23 V) on VTVM
4	VU-Meter Adjustment	Same as above, plus reference level signal from test tape	VU-meter	Same as above, but Output Selector at REPRO	R307 and R314	0 VU reading on VU meter
5	PEAK LED	1 kHz, +16 dBm (250 nWb/m)/+14 dBm (320 nWb/m) from oscillator	PEAK LED	Stop mode, Output Selector at INPUT	R309	Lighting up LEDs
6	Reproduce Level (via Repro Head)	Reproduce alignment test tape (7-1/2 ips)	VTVM connected to OUTPUTs	Reproduce at 7-1/2 ips, Output Selector at REPRO	R301	+4 dBm (1.23 V) on VTVM
7	Reproduce Level (via Record/Sync Head)	Same as above	Same as above	Reproduce at 7-1/2 ips, Output Selector at SYNC	R302	Same as above
8	Reproduce EQ at 15 ips (via Repro Head)	16 kHz signal on test tape	VTVM connected to OUTPUTs	Reproduce at 15 ips, Output Selector at REPRO	R303	Same reading on VTVM as for 400 Hz signal
9	Reproduce EQ at 7-1/2 ips (via Record/Sync Head)	Same as above	Same as above	Reproduce at 15 ips, Output Selector at SYNC	R304	Same as above
10	Reproduce EQ at 7-1/2 ips (via Repro Head)	Same as above	Same as above	Reproduce at 7-1/2 ips, Output Selector at REPRO	R305	Same as above
11	Reproduce EQ at 7-1/2 ips (via Record/Sync Head)	Same as above	Same as above	Reproduce at 7-1/2 ips, Output Selector at SYNC	R306	Same as above
12	Bias tuning	No input signal	VTVM connected to test points, negative lead to TP-2, positive lead to TP-3 (For gapless punch-in models : VTVM connected between TP-1 (CH1)/TP-2 (CH2) on AMP CONT PCB and TP-2 on R/P AMP PCB)	Repro mode with no input signal	L4 L101(CH1)/L202 (CH2)	Minimum output at test points Minimum output at test points

CHECKS AND ADJUSTMENTS CHART (2/2)

AD-JUST MENT	WHAT IS IT CALLED	SIGNAL SOURCE AND AMOUNT	WHAT TEST GEAR TO USE	WHAT IS THE RECORDER DOING	POINT TO ADJUST	WHAT READING TO ADJUST FOR
13	Bias Trap Adjustment	No input signal	VTVM connected to Bias trap test points TP-1 and TP-5 (GND)	Record mode with no input signal	U9	Minimum output at bias test points
14	Bias Level Adjustment	10 kHz, -6 dBm from oscillator connected to INPUTs	VTVM connected to OUTPUTs	Recording on the same type of tape as used for actual recording, at 7-1/2 ips, Output Selector at REPRO	C101	6.5 to 7.5 dB below the "second" peak level
15	Record Level at 7-1/2 ips	1 kHz, +4 dBm (0 VU on VU meter) connected to INPUTs	VTVM connected to OUTPUTs, or VU meter instead	Recording at LOW then its playback	R310	+4 dBm on VTVM, or 0 VU on VU meter
16	Record Level at 15 ips	Same as above	Same as above	Recording at HIGH then its playback	R313	Same as above
17	Overall Frequency at 15 ips	22 kHz, -6 dBm signal from oscillator connected to INPUTs	Same as above	Same as above	R311	Same reading on VTVM as for 1 kHz
18	Overall Frequency at 7-1/2 ips	22 kHz, -16 dBm signal from oscillator connected to INPUTs	Same as above	Recording at LOW then its playback	R312	Same as above
19	Overall Signal-To-Noise Ratio	No input signal	VTVM connected to OUTPUTs	Recording at 15 or 7-1/2 ips, Output Selector at REPRO	Check only	Check for 50 dB or better
20	Erasure	1 kHz, +14 dBm connected to INPUTs (i.e., +10 VU on VU meters). Apply signal for short time only.	VTVM and 1 kHz band pass filter connected to OUTPUTs	1 kHz signal recording, then no-signal recording over the 1 kHz recording. Output Selector at REPRO	Check only	Check for 70 dB or greater (through 1 kHz filter)

7. OPTIONAL MODIFICATIONS

There are two DIP-switches on the Control PC Board inside the BR-20. Their default settings and functions are as follows :

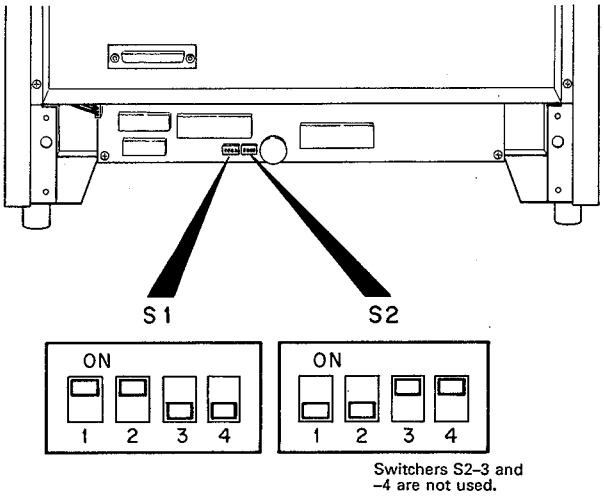


Figure 7-1. DIP-switch Locations

S1–1 : ON (Memory Back-up feature is active)
S1–2 : ON (Fader Stop function is available)

- Fader Start function can also be switched on/off. As for the procedure, see the "Features and Controls" section of this manual, item 43.

The next S1-3 switch has no effect on the NAB standard U.S.A/Canada model.

S1–3 : OFF (Gapless punch-in and spot erase are active)

Note : S1–3 is a "defeat" switch and "OFF" means the function is NOT defeated.

S1–4 : OFF (Tape speed is switchable between 7.5 inch/s (19 cm/s) and 15 inch/s (38 cm/s)

- ON position is for 3-3/4 and 7-1/2 inch/s (9.5 and 19 cm/s) tape speeds. This entails installation of some internal parts. Consult TASCAM or your nearest TASCAM dealer.

S2–1 : OFF (On-the-fly tape point capture and its storage into memory are done at once by hitting a MEMO key alone.)

- With this switch set to ON, MEMO only captures the current tape point, and, when NUMBER is subsequently pressed, that point is actually memorized.

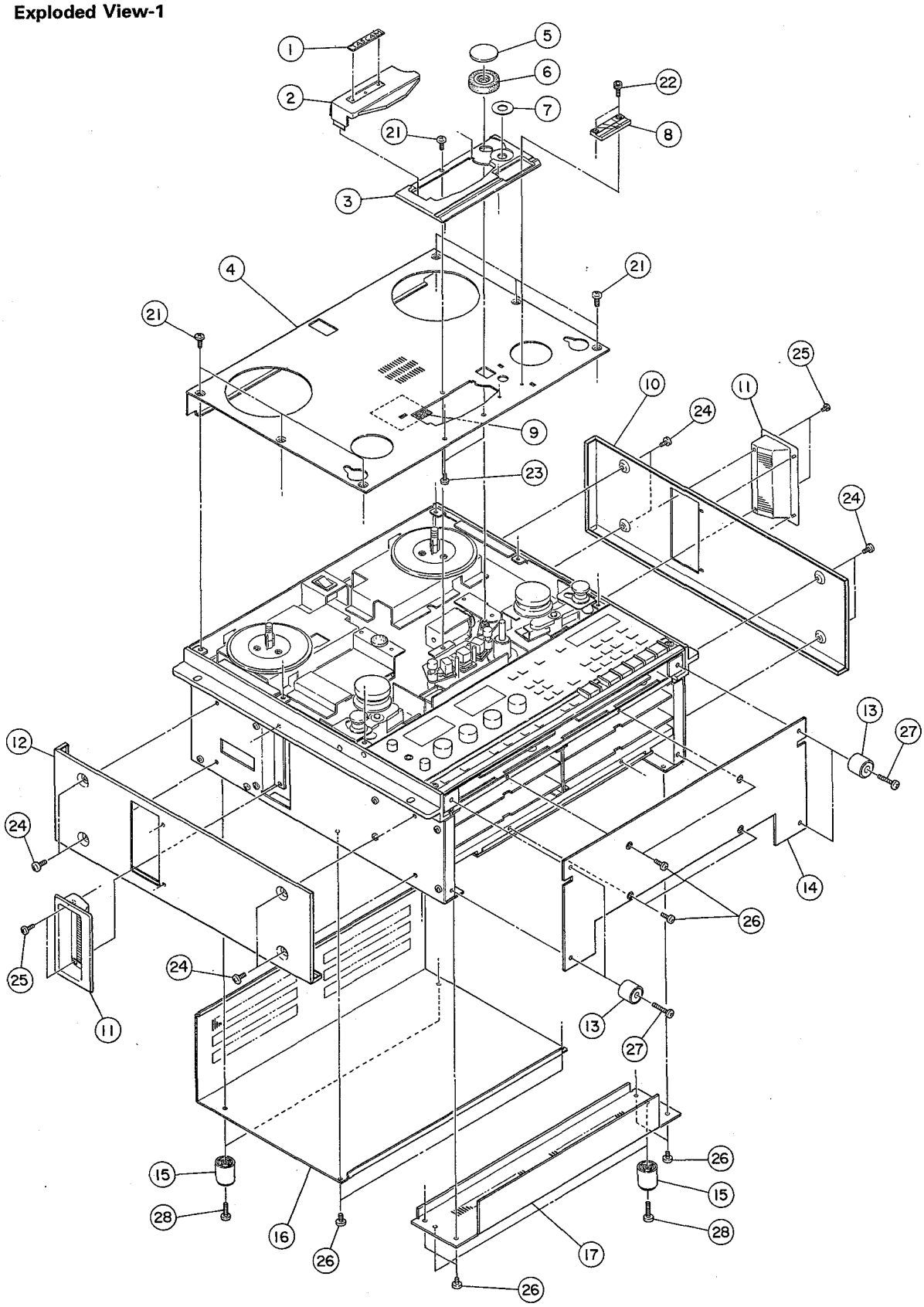
S2–2 : OFF (Monitor source : INPUT, SYNC, and REPRO, can be selected for the separate channels)

- With this switch set to ON, both channels' monitor sources are selected at once by either channel's selector switch.

8. PARTS LIST

8-1. Mechanics

Exploded View-1



EXPLODED VIEW-1

REF.NO.	PARTS NO.	DESCRIPTION	REMARKS
1- 1	*5720225800	BADGE,TASCAM	
1- 2	*5801382300	HOUSING,HEAD	
1- 3	*5801382500	BASE,HOUSING	
1- 4	*5801381500	PANEL,DRESS	
1- 5	5801377400	CAP,PINCH ROLLER	
1- 6	5801377300	ROLLER,PINCH	
1- 7	*5801382600	RING,CAPSTAN	
1- 8	*5801382700	BLOCK,SPLISING	
1- 9	*5801384000	BLIND,SP	
1-10	*5801381700	PANEL(R),SIDE	
1-11	*5801383000	HANDLE	
1-12	*5801381600	PANEL(L),SIDE	
1-13	*5801392200	FOOT(23)	
1-14	*5801387600	COVER ASSY,BOTTOM	
1-15	*5801392300	FOOT(28)	
1-16	*5801381800	COVER,TOP	
1-17	*5801381900	COVER,REAR	
1-21	*5780413006	SCREW,TRUSS M3X6(NI)	
1-22	*5781702606	BOLT,HEXAGON SKT M2.6X6(NI)	
1-23	*5783602604	SCREW,BIND P-TITE M2.6X4	
1-24	*5780424008	SCREW,TRUSS M4X8(BLK NI)	
1-25	*5780023008	SCREW,BIND M3X8(BLK NI)	
1-26	*5780023006	SCREW,BIND M3X6(BLK NI)	
1-27	*5780104012	SCREW,PAN M4X12	
1-28	*5780104020	SCREW,PAN M4X20	

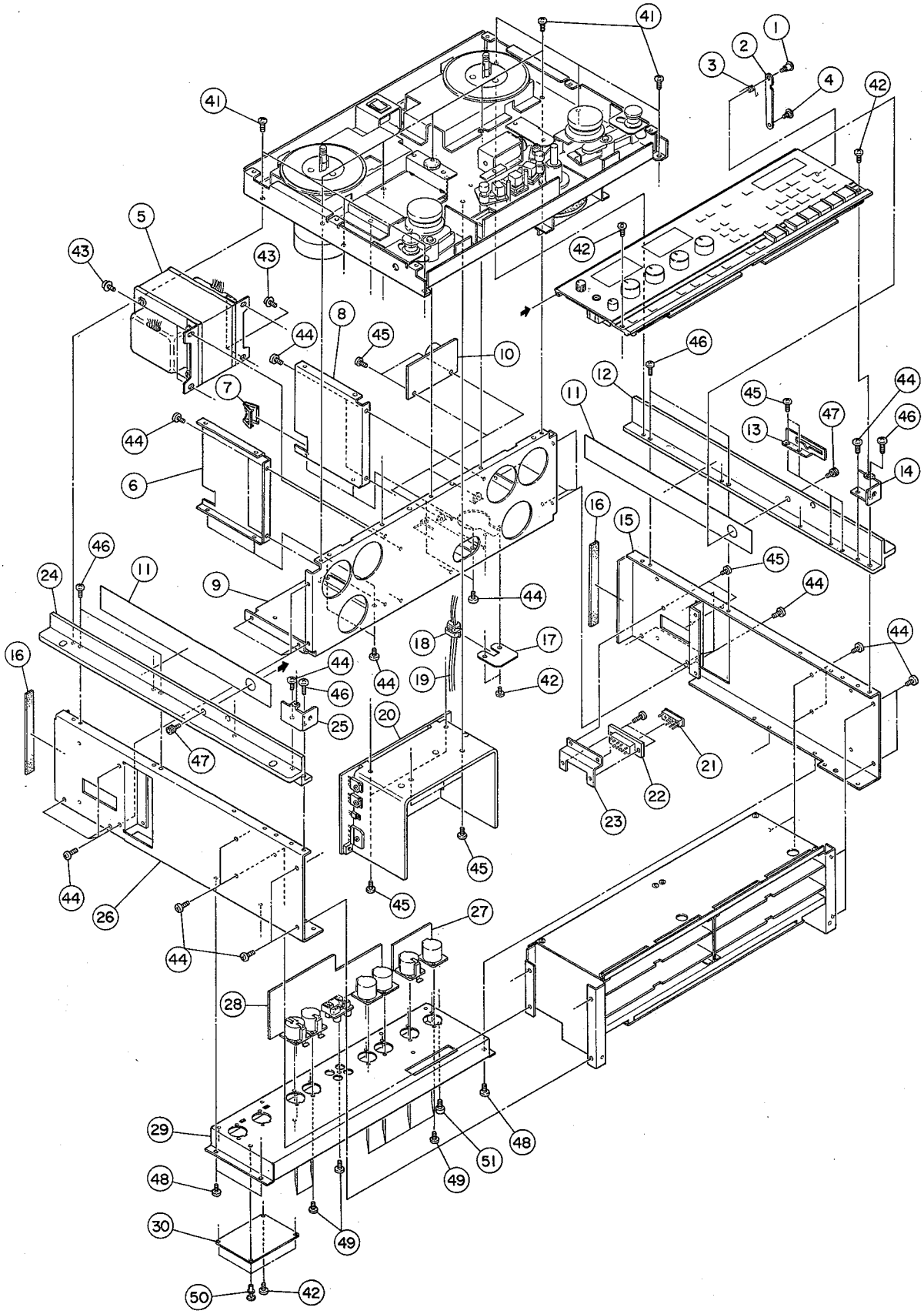
INCLUDED ACCESSORIES

REF.NO.	PARTS NO.	DESCRIPTION	REMARKS
	*5700122700	OWNER'S MANUAL [J]	
	*5700122800	OWNER'S MANUAL [EXCEPT J]	
	*5744078500	CLAMPER,REEL TZ-614	
	*5740002700	REEL,RE1004	
	*5780104030	SCREW,PAN M4X30	
	*5534659000	SPACER,CI[J]	
	*5544995000	WASHER,M5(NI)[J]	
	*5780215015	SCREW,FLAT M5X15(NI)[J]	

[US]:U.S.A. [E]:EUROPE [UK]:U.K. [C]:CANADA [J]:JAPAN
[GE]:GENERAL EXPORT [A]:AUSTRALIA

Parts marked with *require longer delivery time.

Exploded View-2



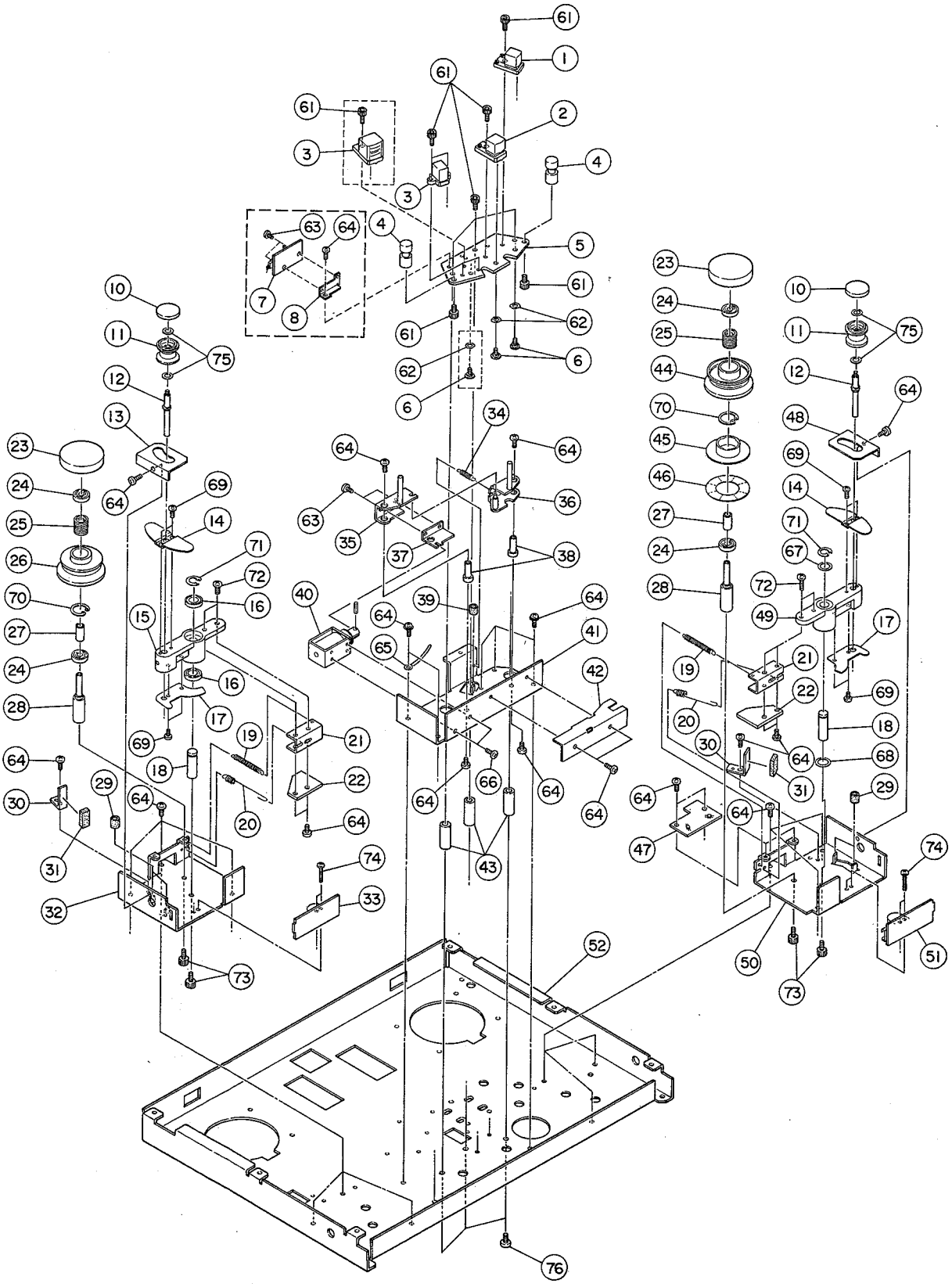
EXPLODED VIEW-2

REF.NO.	PARTS NO.	DESCRIPTION	REMARKS
2- 1	*5801367400	SCREW(J),STEP	
2- 2	*5801367100	STAY,HINGE	
2- 3	*5801367300	SPRING,HINGE	
2- 4	*5800404400	SCREW,SHOULDER(B)	
2- 5	⚠ 5320059100	TRANSFORMER,POWER[J]	
	⚠ 5320059200	TRANSFORMER,POWER[US,C]	
	⚠ 5320059300	TRANSFORMER,POWER[GE]	
	⚠ 5320059400	TRANSFORMER,POWER[E,UK,A]	
2- 6	*5801379600	PLATE(L),POWER SUPPLY REINFORCEMENT	
2- 7	*5730038500	HOLDER	
2- 8	*5801379700	PLATE(R),POWER SUPPLY REINFORCEMENT	
2- 9	*5801379500	BASE,POWER SUPPLY	
2-10	*5200309600	N FILTER PCB ASSY[J,US,C,GE]	Refer to pages 44 & 51
	*5200309700	N FILTER PCB ASSY[E,UK,A]	Refer to pages 44 & 51
2-11	*5801382100	SPACER,TRANSPORT	
2-12	*5801381100	SASH(R),SIDE	
2-13	*5801367200	GUIDE,HINGE	
2-14	*5801367000	SUPPORT(R),AMPL. PANEL	
2-15	*5801381300	CHASSIS(R),SIDE	
2-16	*5801381400	CUSHION,COVER	
2-17	*5801391600	PLATE	
2-18	⚠ *5317003400	BUSSING,2271	
2-19	⚠ *5128027000	CORD,AC[J]	
	⚠ *5128047000	CORD,AC[UK]	
	⚠ *5350008200	CORD,AC[E]	
	⚠ *5350008300	CORD,AC[A]	
	⚠ *5350010700	CORD,AC[US,GE]	
	⚠ *5350012200	CODE,AC[C]	
2-20	*5200306500	PS PCB ASSY[J,US,C,GE]	Refer to pages 45 & 52
	*5200306600	PS PCB ASSY[E,UK,A]	Refer to pages 45 & 52
2-21	⚠ 5133014000	PLUG,VOLTAGE SELECT[GE]	
2-22	⚠ 5133015001	SOCKET,VOLTAGE SELECT 100-240V[GE]	
2-23	*5801391700	BRACKET,SELECTOR[GE]	
2-24	*5801381000	SASH(L),SIDE	
2-25	*5801366900	SUPPORT(L),AMPL. PANEL	
2-26	*5801381200	CHASSIS(L),SIDE	
2-27	*5200307600	TC IN/OUT PCB ASSY(-20T ONLY)	Refer to pages 48 & 54
2-28	*5200307100	IN/OUT AMPL PCB ASSY	Refer to pages 43 & 51
2-29	*5801380800	PANEL,REAR	
2-30	*5801380900	PLATE,BLIND	
2-41	*5780104008	SCREW,PAN M4X8	
2-42	*5780023006	SCREW,BIND M3X6(BLK NI)	
2-43	*5780144010	SCREW,PAN SEMS-B M4X10	
2-44	*5780104008	SCREW,PAN M4X8	
2-45	*5780003006	SCREW,BIND M3X6	
2-46	*5780104012	SCREW,PAN M4X12	
2-47	*5781703006	BOLT,HEXAGON SKT M3X6(NI)	
2-48	*5780023008	SCREW,BIND M3X8(BLK NI)	
2-49	*5783543008	SCREW,BIND P-TITE M3X8(BLK NI)	
2-50	*5786610200	RIVET,PUSH RP-3045-NB	
2-51	*5783613008	SCREW,B.CT M3X8(BLK NI)	

[US]:U.S.A. [E]:EUROPE [UK]:U.K. [C]:CANADA [J]:JAPAN
[GE]:GENERAL EXPORT [A]:AUSTRALIA

Parts marked with *require longer delivery time.

Exploded View-3



EXPLODED VIEW-3

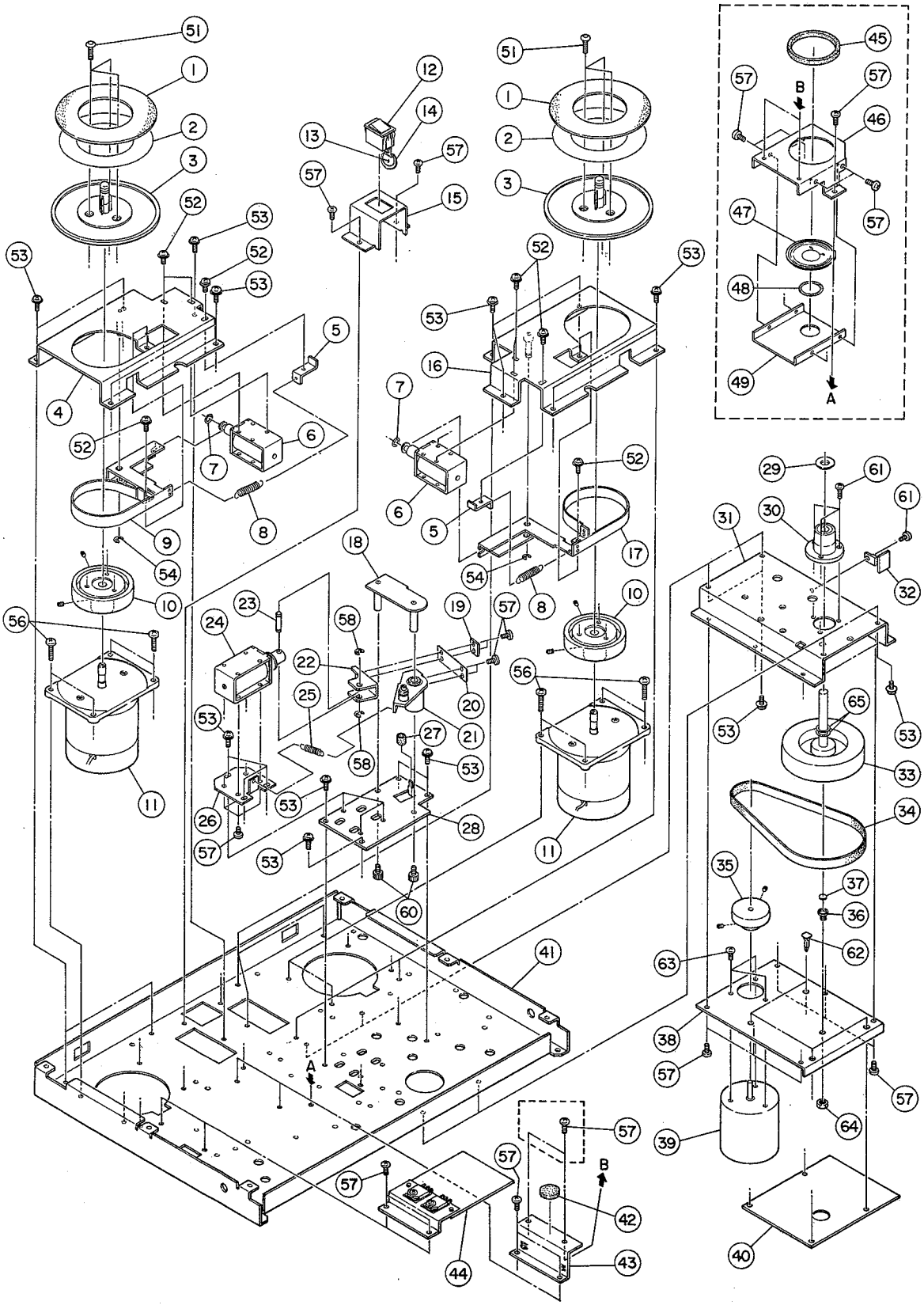
REF.NO.	PARTS NO.	DESCRIPTION	REMARKS
3- 1	5801386500	HEAD ASSY(NAB),R/P(-20N)	
	5801386600	HEAD ASSY(DIN),R/P(-20D)	
	5378302300	HEAD ASSY(NAB),R/P(-20T)	
3- 2	5801386500	HEAD ASSY(NAB),R/P(-20N)	
	5801386600	HEAD ASSY(DIN),R/P(-20D)	
	5378309200	HEAD ASSY,R/P(-20T)	
3- 3	5801386100	HEAD ASSY(NAB),ERASE(-20N)	
	5801386200	HEAD ASSY(DIN),ERASE(-20D)	
	5378309300	HEAD ASSY,ERASE(-20T)	
3- 4	5801375600	GUIDE,TAPE	
3- 5	*5801375300	BASE,HEAD	
3- 6	*5800348701	SCREW,HEAD	
3- 7	*5200310600	SPEAKER SW PCB ASSY[-20N(J,US,C),-20T(J)]	Refer to pages 47 & 54
3- 8	*5801396600	BRACKET,SP SW[-20N(J,US,C),-20T(J)]	
3- 9	Vacant		
3-10	5801382200	CAP,TENSION	
3-11	5801372800	ROLLER ASSY,TENSION	
3-12	*5801372500	SHAFT ASSY,TENSION	
3-13	*5801373200	BLIND(L),TENSION	
3-14	*5801372400	FLAG,TENSION	
3-15	*5801371900	ARM,TENSION	
3-16	1603068000	BEARING,NSK688ZZS	
3-17	*5801372300	SHUTTER	
3-18	*5801373100	SHAFT,TENSION ARM	
3-19	*5801382900	SPRING,TENSION ARM	
3-20	*5801382800	SPRING,TENSION	
3-21	*5801372100	PLATE,SPRING	
3-22	*5801372200	WEIGHT,COUNTER	
3-23	*5801373700	CAP,ROLLER	
3-24	5730038800	BEARING,NSK625ZZMC3EPS2	
3-25	*5801374100	SPRING,ROLLER	
3-26	5801373600	ROLLER	
3-27	*5801374000	SLEEVE,BEARING	
3-28	*5801373400	SHAFT,ROLLER	
3-29	*5534850000	CUSHION,STOPPER	
3-30	*5801374200	BRACKET,DAMPER	
3-31	*5801386000	SPONGE,DAMPER	
3-32	*5801371600	BASE(L),TA	
3-33	*5200308200	SENSOR L PCB ASSY	Refer to pages 47 & 53
3-34	*5801375200	SPRING,LIFTER RETURN	
3-35	*5801374400	ARM(L) ASSY,LIFTER	
3-36	*5801374800	ARM(R) ASSY,LIFTER	
3-37	*5801374700	ARM,ACTUATING	
3-38	*5801375100	SHAFT,LIFTER	
3-39	*5027569000	CUSHION	
3-40	5313004700	SOLENOID,LIFTER	
3-41	*5801374300	BASE,LIFTER	
3-42	*5801375500	PLATE(2),SHEILD	
3-43	*5801369100	STAY,HEAD BASE	
3-44	5801373500	ROLLER,F	
3-45	*5801373800	SUPPORT,DISK	
3-46	*5801373900	DISK,TG	
3-47	*5200308400	PG PCB ASSY	Refer to pages 47 & 53
3-48	*5801373300	BLIND(R),TENSION	
3-49	*5801371800	ARM ASSY,TENSION	

(Continued on page 37)

[US]:U.S.A. [E]:EUROPE [UK]:U.K. [C]:CANADA [J]:JAPAN
[GE]:GENERAL EXPORT [A]:AUSTRALIA

Parts marked with *require longer delivery time.

Exploded View-4



EXPLODED VIEW-4

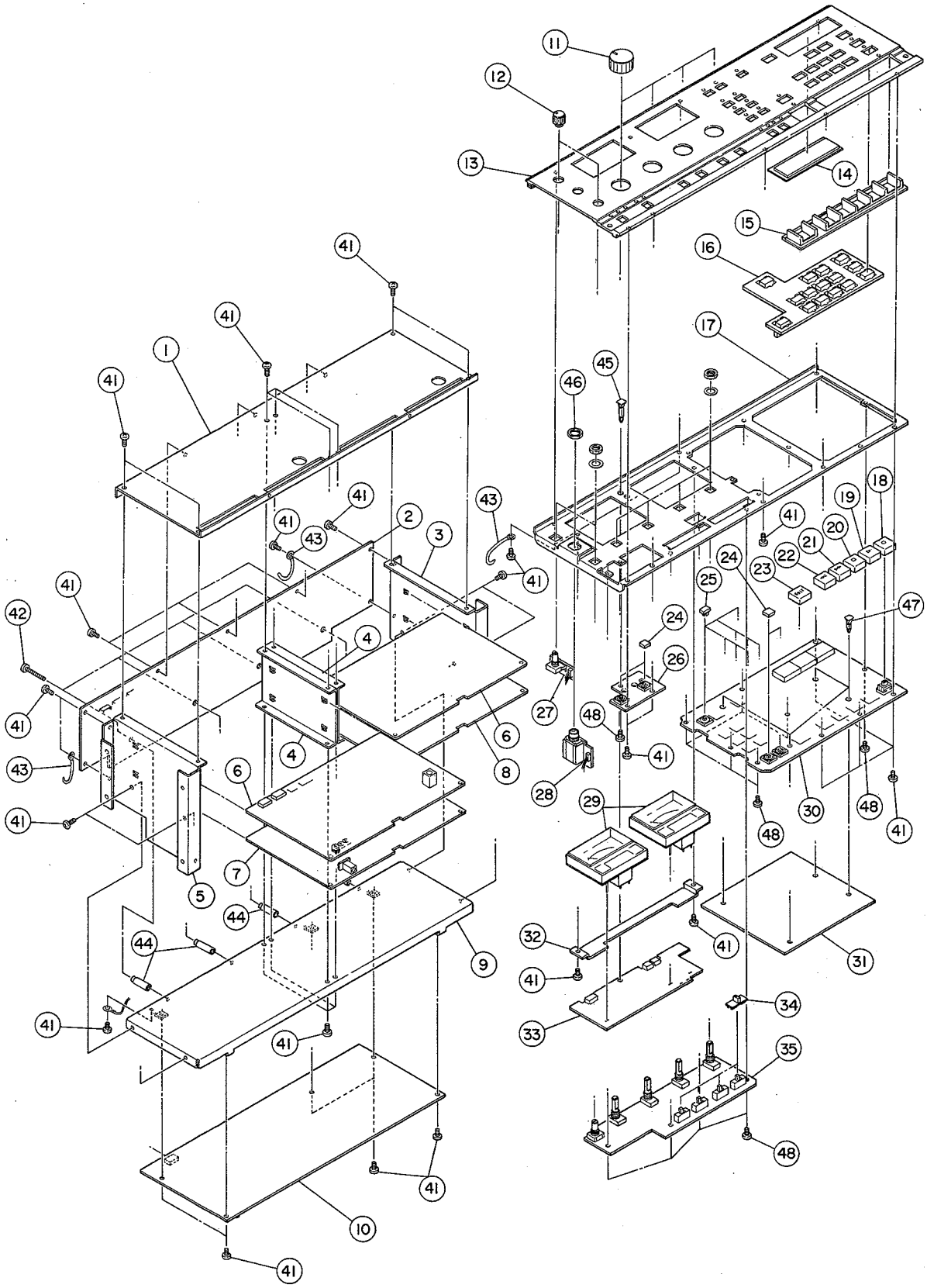
REF.NO.	PARTS NO.	DESCRIPTION	REMARKS
4- 1	5801371500	SHEET,REEL	
4- 2	*5801383900	TAPE,REEL SHEET ADHESIVE	
4- 3	5801370900	TABLE ASSY,REEL	
4- 4	*5801391300	BASE ASSY(L),BRAKE	
4- 5	*5801370400	HOOK,SPRING	
4- 6	5313004500	SOLENOID,BRAKE	
4- 7	*5730038900	O-RING,P5	
4- 8	*5801370500	SPRING,BRAKE	
4- 9	5801369600	BAND ASSY(L),BRAKE	
4-10	5801370800	DRAM,BRAKE	
4-11	5370008400	MOTOR,REEL DC	
4-12	*5302109500	SW,SEESAW JW-M11RKK	
4-13	⚠ 5267703800	C.,SPARK KILL. 4700PF 400V M	
4-14	*5730007500	COVER,CAPASITOR SB-1417	
4-15	*5801379400	BRACKET,POWER SW	
4-16	*5801391400	BASE ASSY(R),BRAKE	
4-17	5801369700	BAND ASSY(R),BRAKE	
4-18	*5801376900	TRAY ASSY,ROLLER ARM	
4-19	*5801376800	SUPPORT,PLATE SPRING	
4-20	*5801376700	PLATE SPRING,PINCH ROLLER	
4-21	*5801376200	ARM ASSY,PINCH ROLLER	
4-22	*5801376600	PLATE,PINCH ROLLER OPERATING	
4-23	*5801376100	PIN,SOLENOID	
4-24	5313004600	SOLENOID,PINCH ROLLER	
4-25	*5801377500	SPRING,PINCH ROLLER RETURN	
4-26	*5801376000	BRACKET,SOLENOID	
4-27	*5534850000	CUSHION,STOPPER	
4-28	*5801375800	BASE,PINCH ROLLER	
4-29	*5801378600	SEAL,OIL	
4-30	*5801377800	HOLDER ASSY,METAL	
4-31	*5801377600	BASE,CAPSTAN BASE	
4-32	*5200310800	TRANSISTOR PCB ASSY	Refer to pages 47 & 53
4-33	*5801378200	FLYWHEEL ASSY	
4-34	5801379000	BELT,CAPSTAN	
4-35	*5801378900	PULLEY,MOTOR	
4-36	*5544003000	SCREW,BEARING	
4-37	*5555703000	WASHER,THRUST	
4-38	*5801378800	BRACKET,CAPSTAN MOTOR	
4-39	5370009600	MOTOR,CAPSTN	
4-40	*5200308100	CAPSTAN SERVO PCB ASSY	Refer to pages 44 & 51
4-41	*5801369000	BASE,TRANSPORT	
4-42	*5801369300	CUSHION,PANEL	
4-43	*5801369200	SUPPORT,PANEL	
4-44	*5200308500	JOINT PCB ASSY	Refer to pages 47 & 53
4-45	*5801396500	SPONGE,SP[-20N(J,US,C),-20T(J)]	
4-46	*5801396300	BRACKET(A),SPEAKER[-20N(J,US,C),-20T(J)]	
4-47	*15990670	SPEAKER,EAS-5P108[-20N(J,US,C),-20T(J)]	
4-48	*5730039100	O-RING,P18[-20N(J,US,C),-20T(J)]	
4-49	*5801396400	BRACKET(B),SPEAKER[-20N(J,US,C),-20T(J)]	
4-51	*5781724008	BOLTS,H.SKT BUTTON M4X8	
4-52	*5780143006	SCREW,PAN SEMS-B M3X6	
4-53	*5780143008	SCREW,PAN SEMS-B M3X8	
4-54	*5786004000	E-RING,E-4	
4-55	Vacant		

(Continued on page 37)

[US]:U.S.A. [E]:EUROPE [UK]:U.K. [C]:CANADA [J]:JAPAN
[GE]:GENERAL EXPORT [A]:AUSTRALIA

Parts marked with *require longer delivery time.

Exploded View-5



EXPLODED VIEW-5

REF.NO.	PARTS NO.	DESCRIPTION	REMARKS
5- 1	*5801380300	CHASSIS(F),AMPRIFIER	
5- 2	*5200307200	MOTHER PCB ASSY	Refer to pages 38 & 49
	*5200307210	MOTHER PCB ASSY(-20T ONLY)	Refer to pages 38 & 49
5- 3	*5801380200	CHASSIS(R),AMPLIFIER	
5- 4	*5801380600	CHASSIS,PCB GUIDE	
5- 5	*5801380100	CHASSIS(L),AMPLIFIER	
5- 6	*5200306900	R/P AMPL PCB ASSY	Refer to pages 41 & 50
	*5200306910	R/P AMPL PCB ASSY(GAPLES)	Refer to pages 41 & 50
	*5200306920	R/P AMPL PCB ASSY(-20T ONLY)	Refer to pages 41 & 50
5- 7	*5200307300	AMP CONT PCB ASSY(GAPLES)	Refer to pages 42 & 51
	*5200307310	AMP CONT PCB ASSY	Refer to pages 42 & 51
5- 8	*5200307000	TC AMPL PCB ASSY(-20T ONLY)	Refer to pages 48 & 54
5- 9	*5801380400	CHASSIS(C),AMPRIFIER	
5-10	*5200308000	CONTROL PCB ASSY	Refer to pages 38 & 49
5-11	5801367800	KNOB(B)ASSY,VR	
5-12	5801367500	KNOB(A)ASSY,VR	
5-13	*5801366000	PANEL,AMPLIFIER	
	*5801366100	PANEL,AMPLIFIER(-20T)	
5-14	*5801366200	LENS,COUNTER	
5-15	*5801366400	ESCUTCHEON,BUTTON	
5-16	5801366300	BUTTON,OPERATION	
5-17	*5801366500	CHASSIS,AMPL. FRONT	
5-18	5801368800	BUTTON(C),REC	
5-19	5801368700	BUTTON(C),PLAY	
5-20	5801368600	BUTTON(C),STOP	
5-21	5801368500	BUTTON(C),F.FWD	
5-22	5801368400	BUTTON(C),REW	
5-23	5801368300	BUTTON(C),EDIT	
5-24	5801368200	BUTTON(B)	
5-25	5801368100	BUTTON(A)	
5-26	*5200308800	SPEED SW PCB ASSY	Refer to pages 46 & 53
5-27	*5200308900	PHONE VR PCB ASSY	Refer to pages 47 & 53
5-28	*5200307900	JACK PCB ASSY	Refer to pages 47 & 53
5-29	5296007100	METER,VU	
5-30	*5200308700	OPERATION KEY PCB ASSY	Refer to pages 39 & 50
	*5200308710	OPERATION KEY PCB ASSY(-20T ONLY)	Refer to pages 39 & 50
5-31	*5200308600	OPERATION CPU PCB ASSY	Refer to pages 40 & 50
5-32	*5801366600	SUPPORT,METER	
5-33	*5200307400	PHONE AMPL PCB ASSY	Refer to pages 46 & 52
	*5200307410	PHONE AMPL PCB ASSY(-20T ONLY)	Refer to pages 46 & 52
5-34	5801368900	KNOB,SLIDE	
5-35	*5200307500	VR PCB ASSY	Refer to pages 46 & 52
5-41	*5780003006	SCREW,BIND M3X6	
5-42	*5780103025	SCREW,PAN M3X25	
5-43	*5786713400	CLIP,HARNESS 3.2X6.0X47	
5-44	*5730038400	BUSH,SNAP COLLAR	
5-45	*5787008600	SUPPORT,PCB RSPLS-16L	
5-46	*5317003300	NUT	
5-47	*5787008300	SUPPORT,PCB RSPLS-10L	
5-48	*5780003004	SCREW,BIND M3X4	

Parts marked with *require longer delivery time.

(Continued from page 33)

EXPLODED VIEW-3

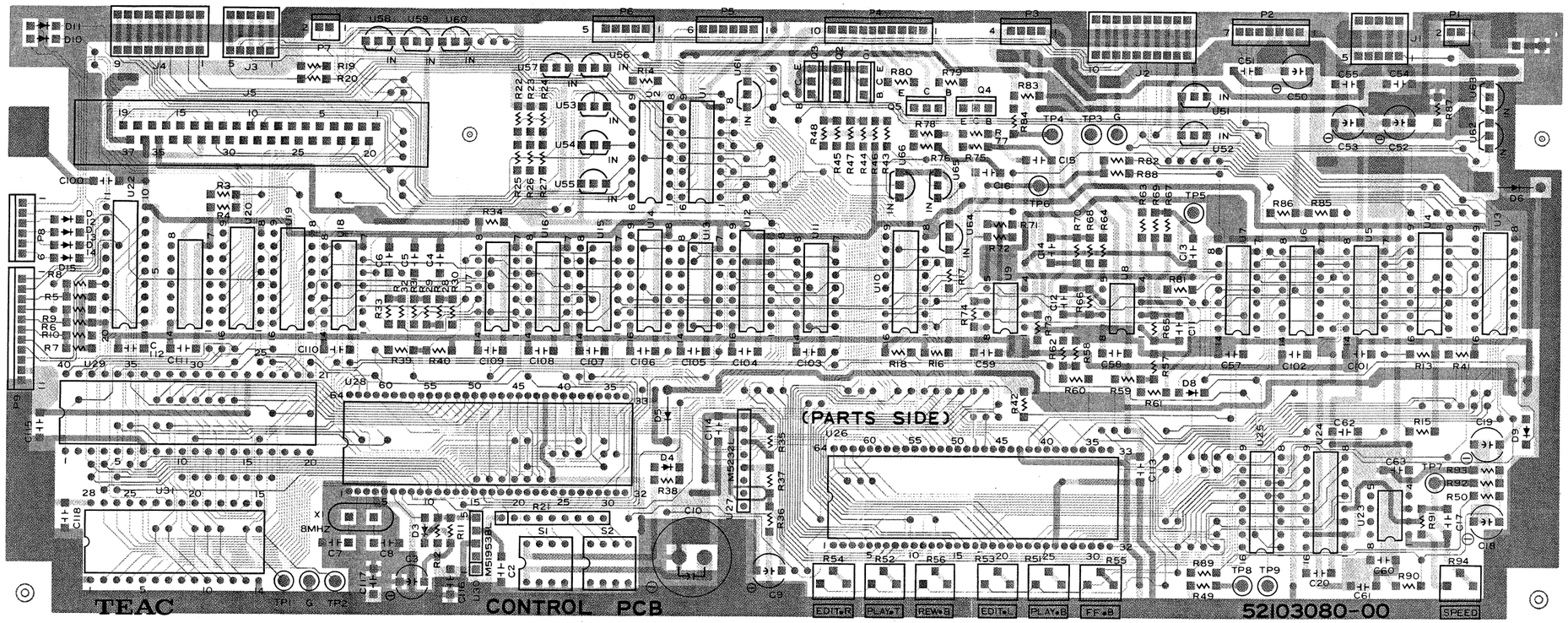
REF.NO.	PARTS NO.	DESCRIPTION	REMARKS
3-50	*5801371700	BASE(R),TA	
3-51	*5200308300	SENSOR R PCB ASSY	Refer to pages 47 & 53
3-52	*5801369000	BASE,TRANSPORT	
3-61	*5781703008	BOLT,HEXAGON SKT M3X8(NI)	
3-62	*5785150400	WASHER,WAVE WW-04	
3-63	*5780002604	SCREW,BIND M2.6X4[-20N(J,US,C),-20T(J)]	
3-64	*5780003006	SCREW,BIND M3X6[-20N(J,US,C),-20T(J)]	
3-65	*5786713400	CLIP,HARNESS	
3-66	*5780003004	SCREW,BIND M3X4	
3-67	*5785318000	WASHER,POLYS. 8X12X0.5T	
3-68	*5785308000	WASHER,POLYS. 8X12X0.25T	
3-69	*5780002004	SCREW,BIND M2X4	
3-70	*5786151600	RING,R IRTW-16	
3-71	*5786160800	RING,S ISTW-8	
3-72	*5780003010	SCREW,BIND M3X10	
3-73	*5781774008	BOLT,HEX M4X8	
3-74	*5780002018	SCREW,BIND M2X18	
3-75	*5785304100	WASHER,POLYS. 4.1X6.5X0.25T	
3-76	*5780104008	SCREW,PAN M4X8	

(Continued from page 35)

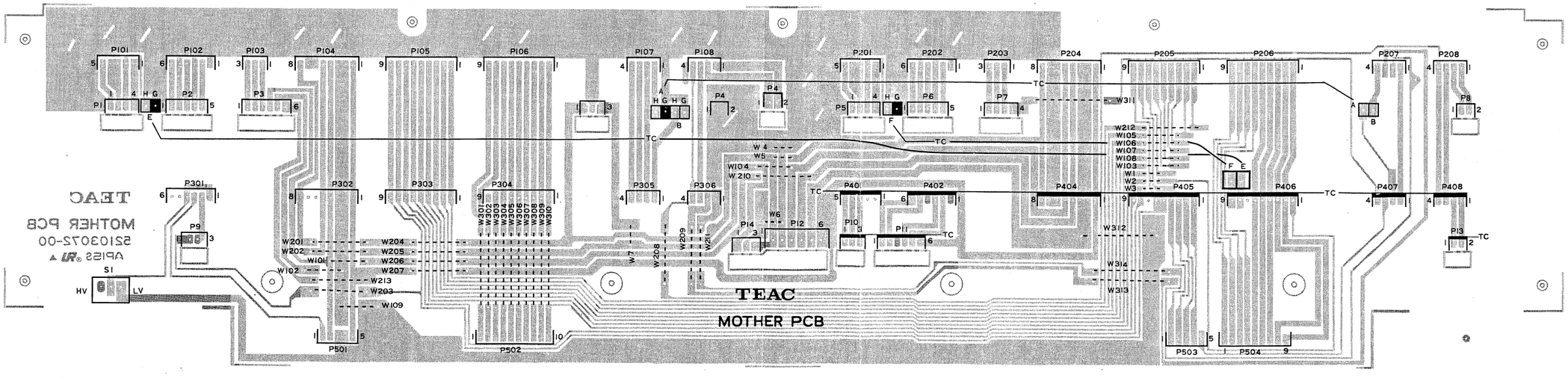
EXPLODED VIEW-4

REF.NO.	PARTS NO.	DESCRIPTION	REMARKS
4-56	*5780104012	SCREW,PAN M4X12	
4-57	*5780003006	SCREW,BIND M3X6	
4-58	*5786003000	E-RING,E-3	
4-59	Vacant		
4-60	*5781774008	BOLT,HEX. SKT M4X8	
4-61	*5780003008	SCREW,BIND M3X8	
4-62	*5787008400	SUPPORT,PCB RSPLS-12L	
4-63	*5780003004	SCREW,BIND M3X4	
4-64	*5781826000	NUT,M6	
4-65	*5785308000	WASHER,POLYS. 8X12X0.25T	

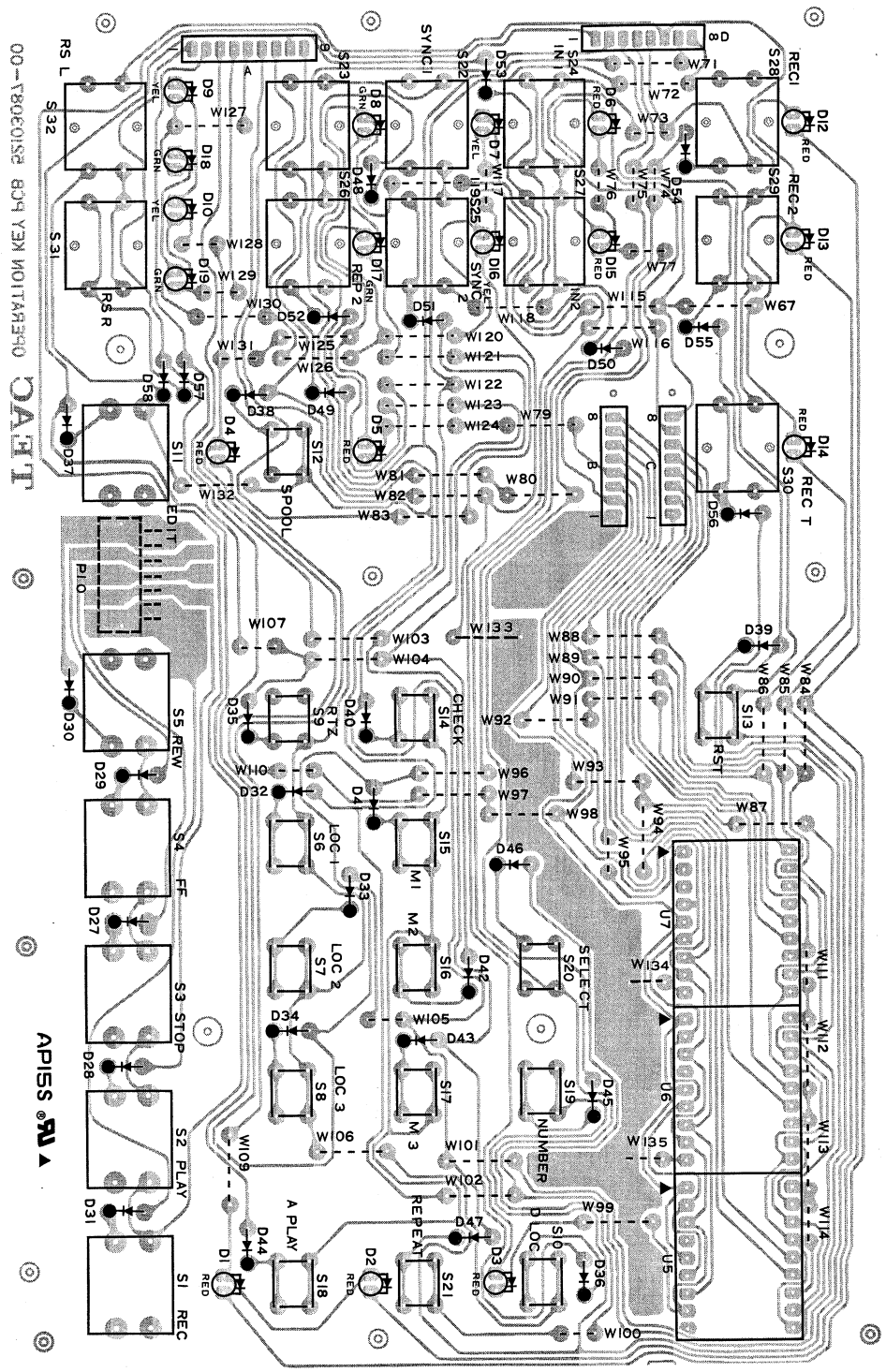
Control PCB Ass'y



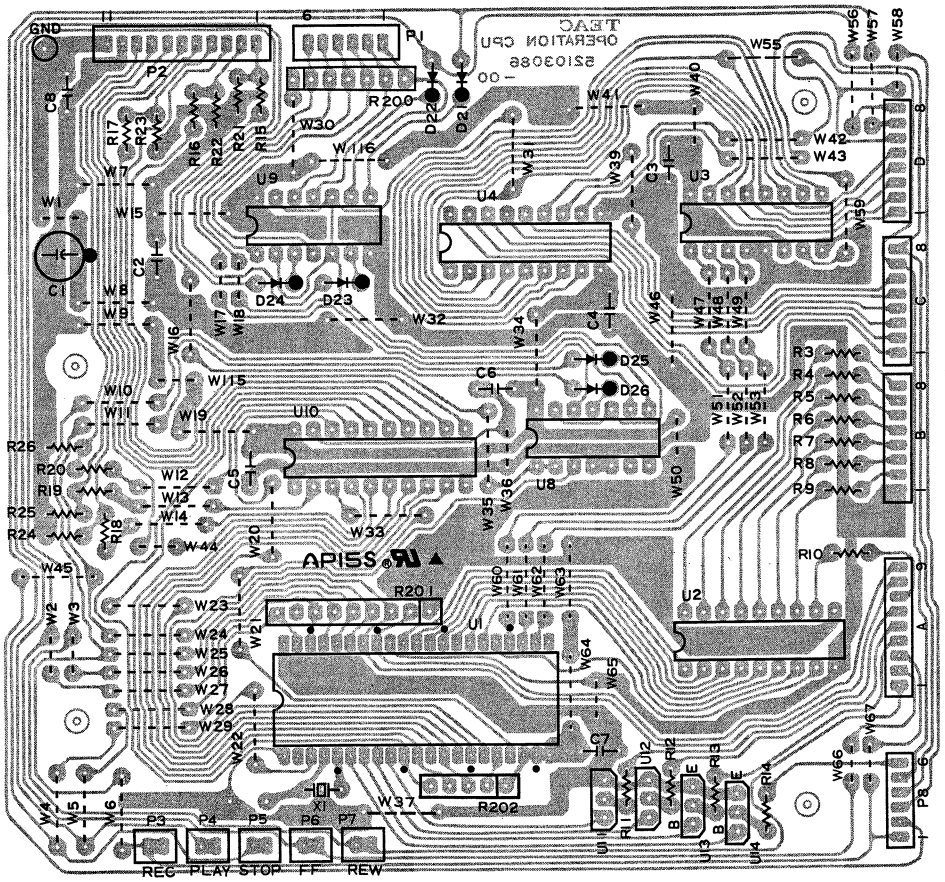
Mother PCB Ass'y



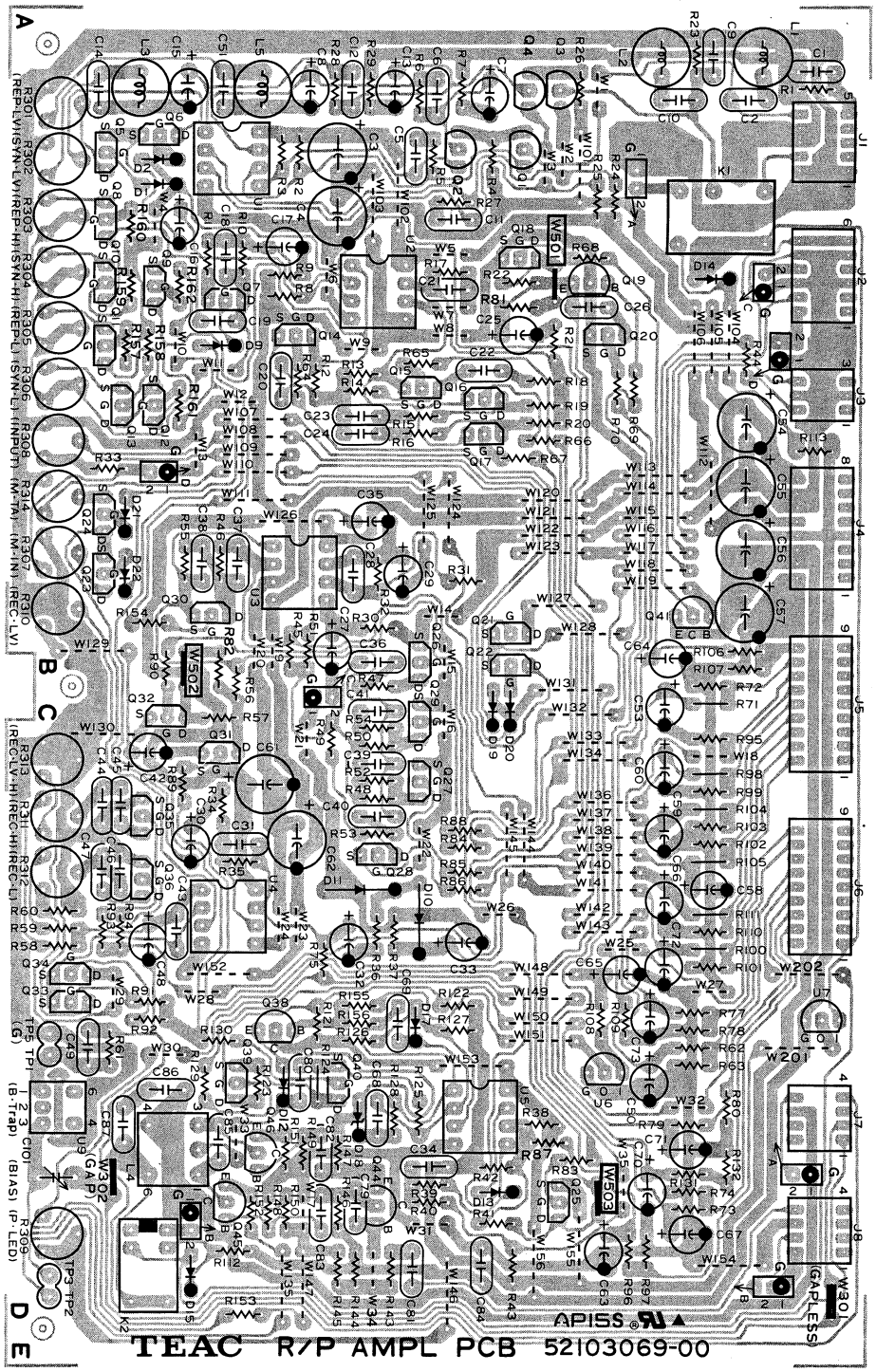
Operation Key PCB Ass'y



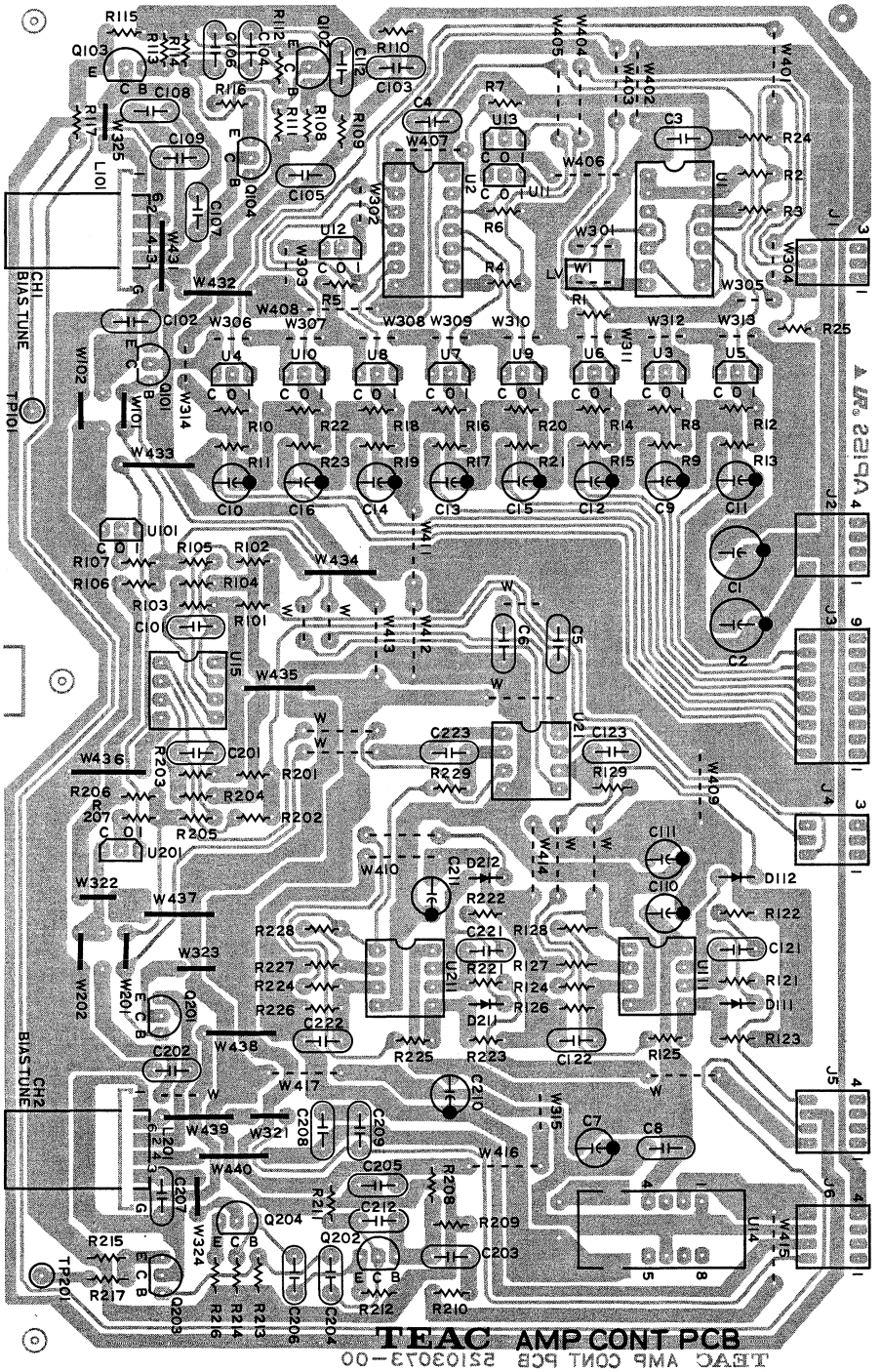
Operation CPU PCB Ass'y



R/P AMPL PCB Ass'y

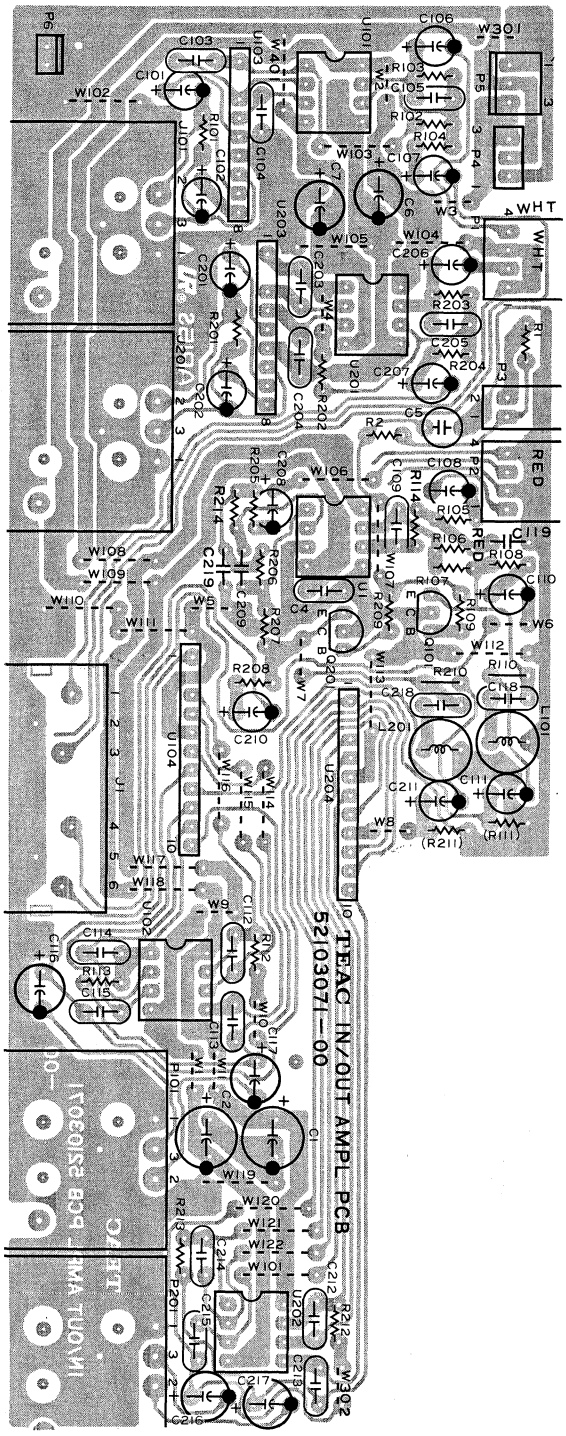


AMP CONT PCB Ass'y

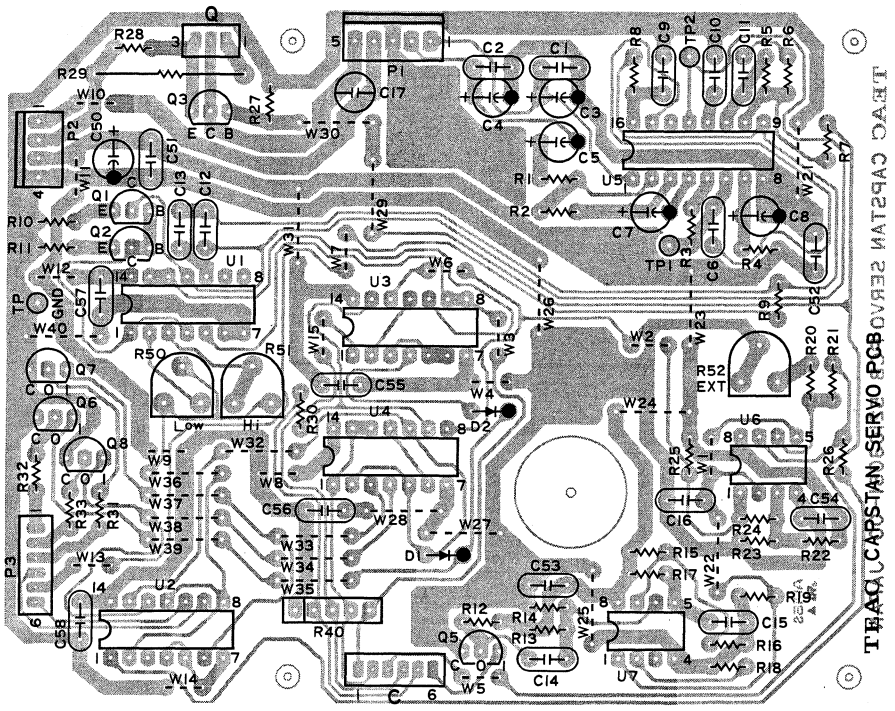


Coil PCB

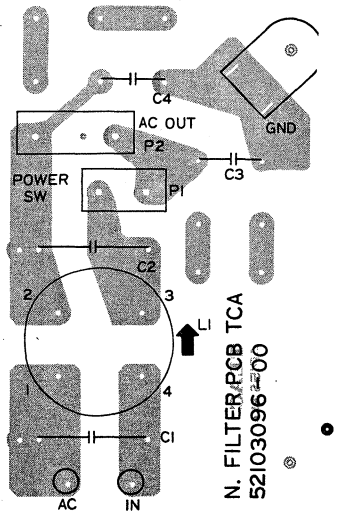
IN/OUT AMPL PCB Ass'y



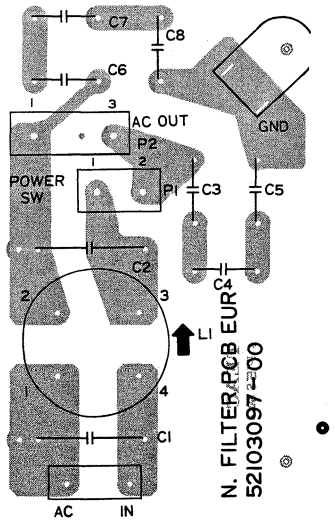
Capstan Servo PCB Ass'y



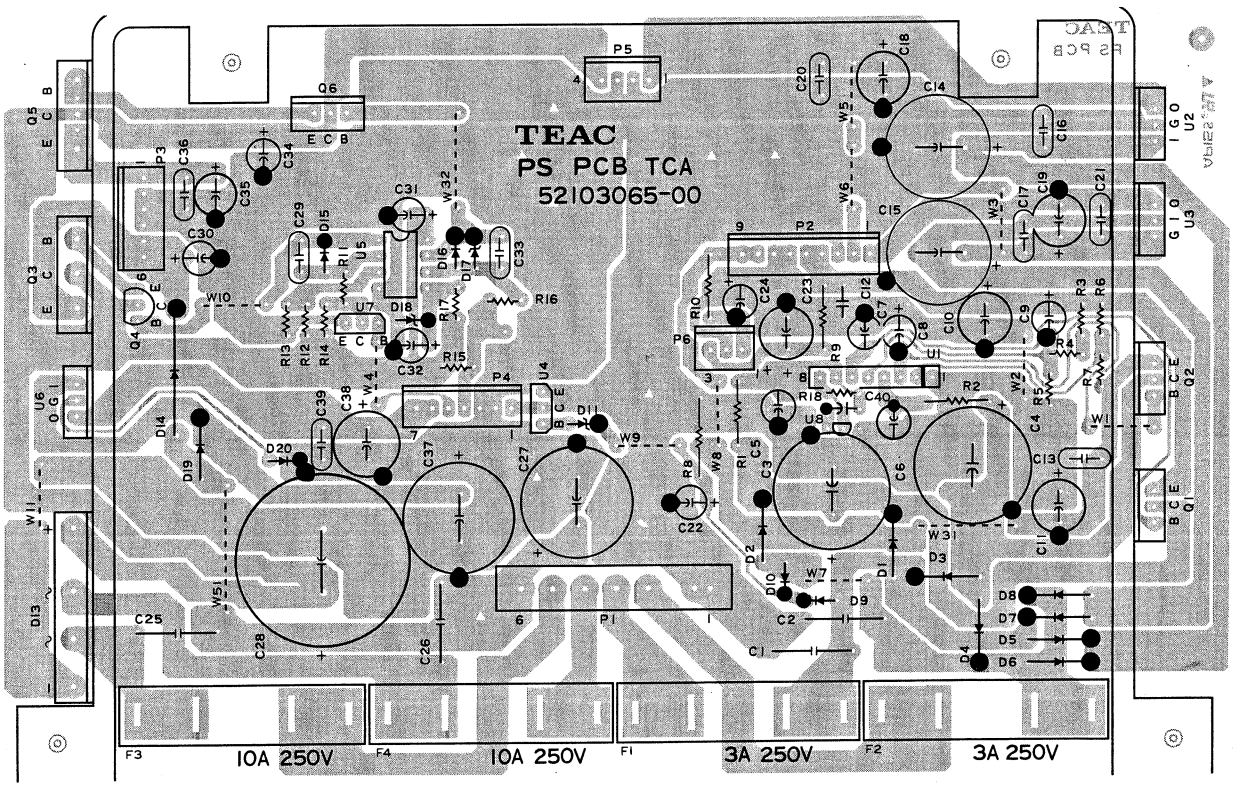
N Filter PCB Ass'y (J, US, C, GE)



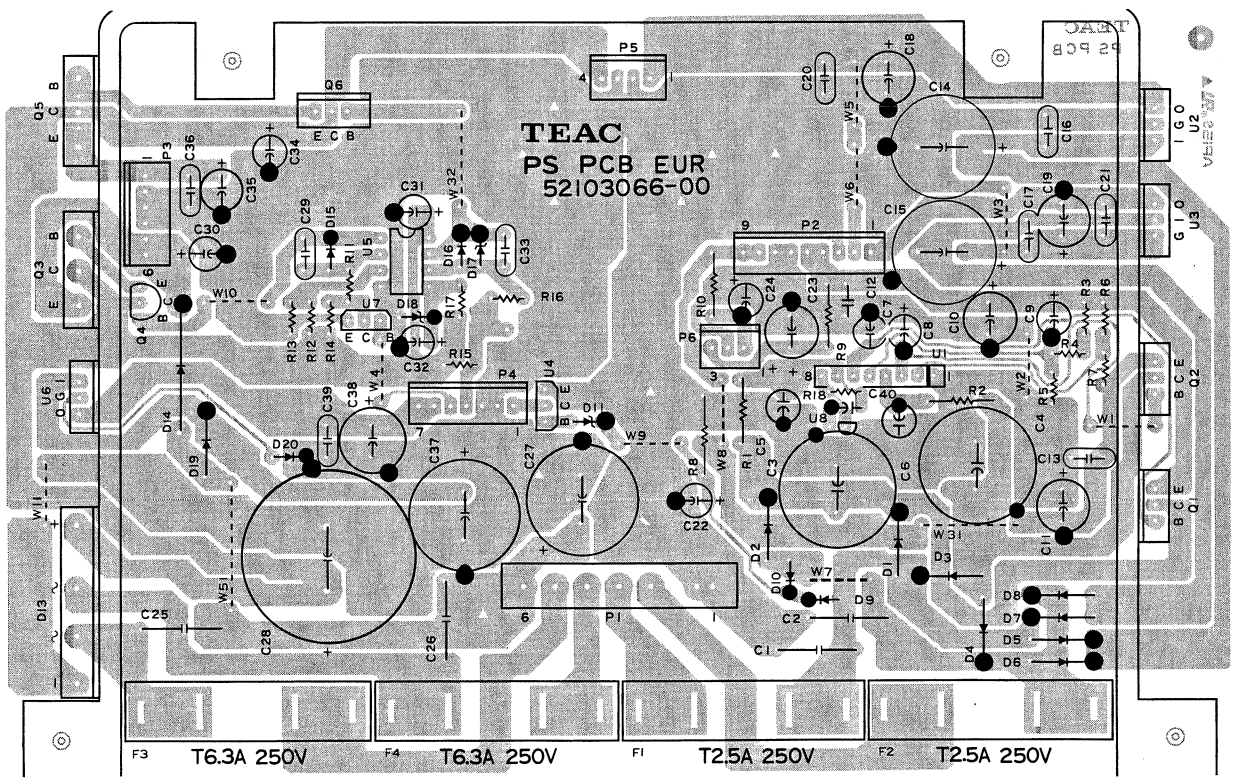
(E, UK, A)



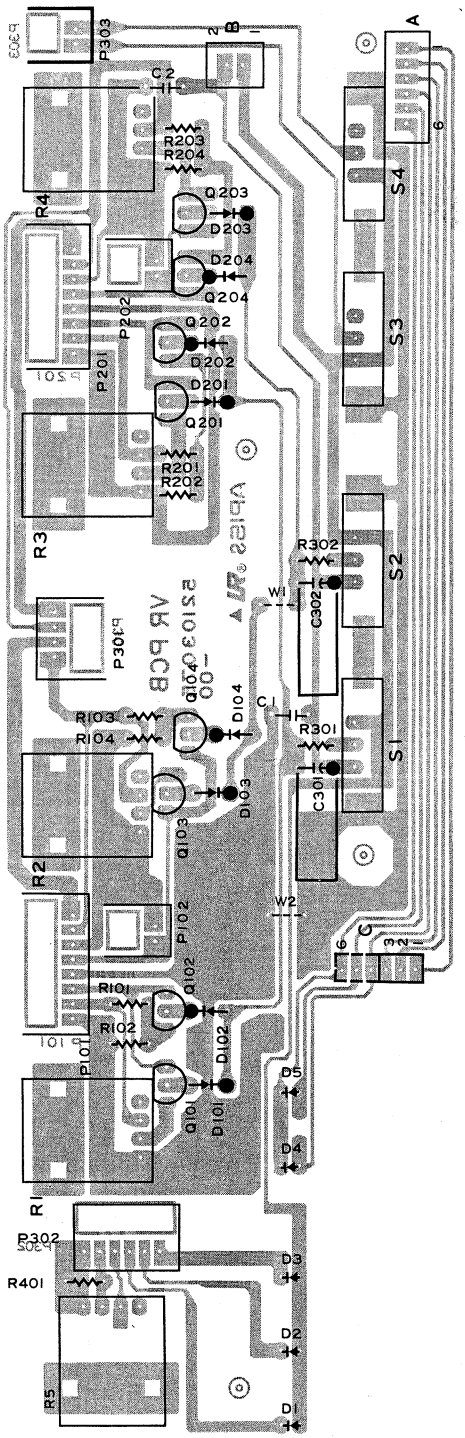
PS PCB Ass'y (J, US, C, GE)



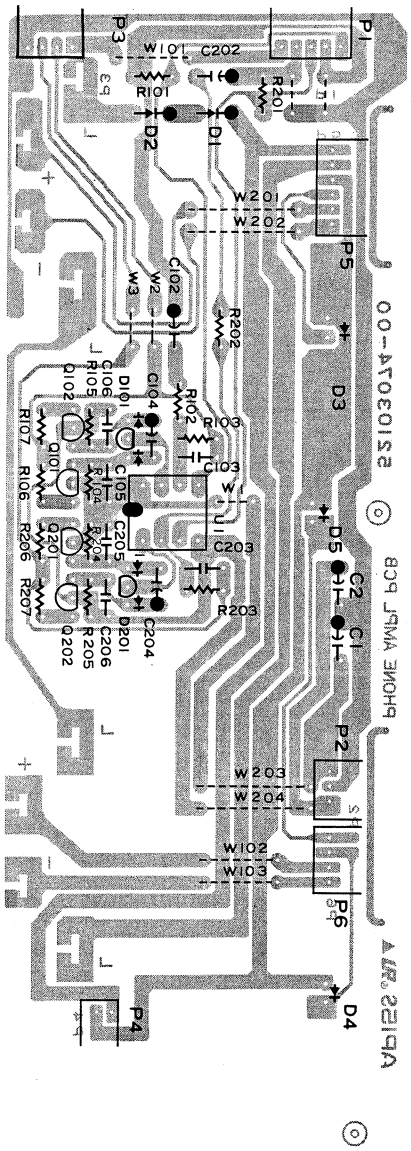
(E, UK, A)



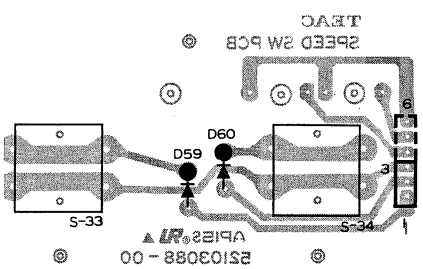
VR PCB Ass'y



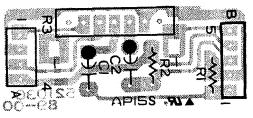
Phone AMPL PCB Ass'y



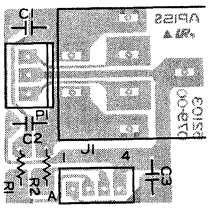
Speed SW PCB Ass'y



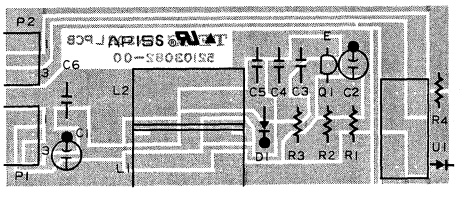
Phone VR PCB Ass'y



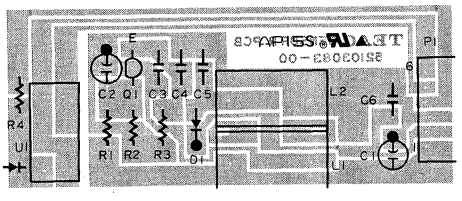
Jack PCB Ass'y



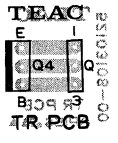
Sensor L PCB Ass'y



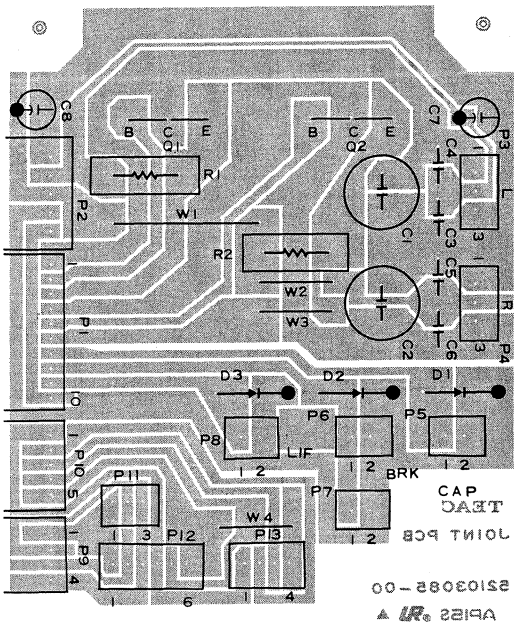
Sensor R PCB Ass'y



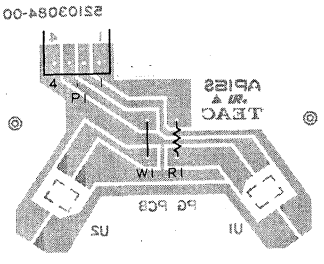
Transistor PCB Ass'y



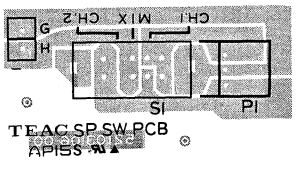
Joint PCB Ass'y



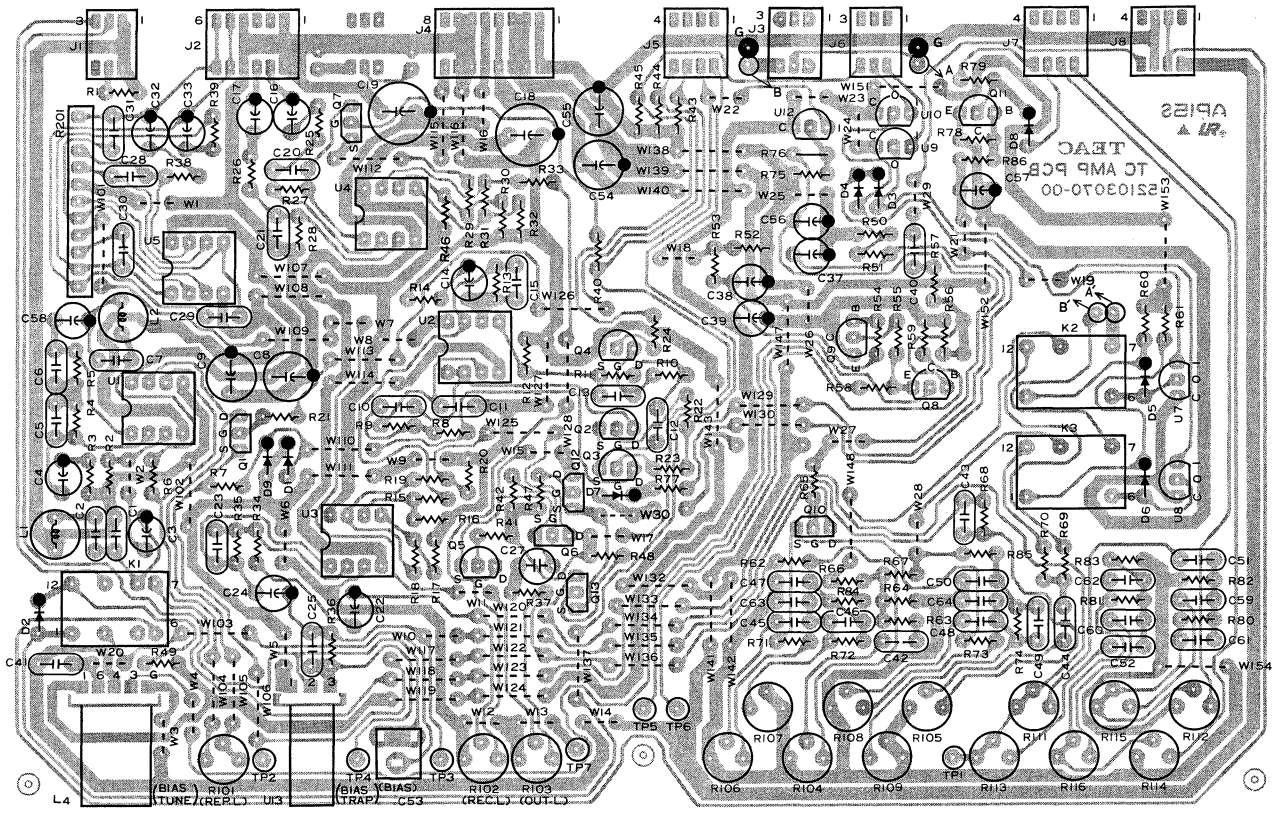
PG PCB Ass'y



Speaker SW PCB Ass'y
[BR-20N (US, C, J), -20T (J)]



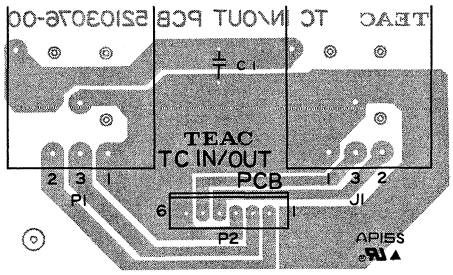
TC AMPL PCB Ass'y [-20T ONLY]



Coil A PCB

Coil B PCB

TC IN/OUT PCB Ass'y [-20T ONLY]



CONTROL PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200308000	CONTROL PCB ASSY
	*5210308000	CONTROL PCB
	*13443075	IC.,HN27C256G-20 EP-ROM
	*5332020900	SOCKET,IC 28P C47-28-11
	*5334066600	CONNECTOR,D-000-N03
	*5801380700	PLATE,D-SUB
	*5302104700	SW.,DIP 4GANG JKS1120
	*5317002100	PIN,DH CHECK IPS-1136
	*5780023008	SCREW,BIND M3X8(BLK NI)
	*5783613008	SCREW,B.CT M3X8(BLK NI)
D3,4	5224015020	DIODE,1SS133T-77
D5	5224016810	DIODE,DINS4 P10
D6	5224013210	DIODE,DS135D FA4 FF
D8-15	5224015020	DIODE,1SS133T-77
J1	5336281500	SOCKET,CONN. IL-SDD-5S-S2L2
J2	5336282000	SOCKET,CONN. IL-SDD-10S-S2L2
J3	5336281500	SOCKET,CONN. IL-SDD-5S-S2L2
J4	5336281900	SOCKET,CONN. IL-SDD-9S-S2L2
J5	5334067500	D-SUB,CONN. YG01411
P1	5336249200	PLUG,CONN. B02B-PH-K-S(WHT)
P2	5336249700	PLUG,CONN. B07B-PH-K-S(WHT)
P3	5336249400	PLUG,CONN. B04B-PH-K-S(WHT)
P4	5336250000	PLUG,CONN. B10B-PH-K-S(WHT)
P5	5336251600	PLUG,CONN. B06B-PH-K-R(RED)
P6	5336249500	PLUG,CONN. B05B-PH-K-S(WHT)
P7	5336251200	PLUG,CONN. B02B-PH-K-R(RED)
P8	5336249600	PULG,CONN. B06B-PH-K-S(WHT)
P9	5336250100	PLUG,CONN. B11B-PH-K-S(WHT)
Q1-3	5231755400	TR.,2SD794Q
Q4,5	5145077000	TR.,2SD-600
R21	5242118600	R.,ARRAY RMLS 8J103
R51-56	5280036100	R.,TRIMMER 4.7KB
R94	5280036900	R.,TRIMMER 100KB
U1-4	5293000900	TR.,ARRAY TD62504P
U10	5293000900	TR.,ARRAY TD62504P
U11	5220051800	IC.,TC74HC04P
U12	5220055900	IC.,TC74HC138P
U13	5220056200	IC.,TC74HC393P
U14	5220052900	IC.,TC74HC390P
U15	5220051600	IC.,TC74HC00P
U16	5220040800	IC.,TC74HC74P
U17	5220052200	IC.,TC74HC86AP
U18	5220051900	IC.,TC74HC14P
U19,20	5293000900	TR.,ARRAY TD62504P
U22	5220052600	IC.,TC74HC244P
U23	5220418800	IC.,M5218P
U24	5220054700	IC.,HA17008RP
U25	5293000900	TR.,ARRAY TD62504P
U26	5220088100	IC.,M5M82C255ASP
U27	5220423600	IC.,M5232L
U28	5220814500	IC.,HD63B03Y
U29	5220815900	LSI.,M5M82C55AP-2
U30	5220430600	IC.,M51953BL
U31	5220824000	IC.,PROGRAMABLE ROM(CNTL)
U5	5220051800	IC.,TC74HC04P
U51-66	5232254820	TR.,DIGI. DTA124ES
U6	5220051700	IC.,TC74HC02P
U7	5220013400	IC.,TC4066BP
U8,9	5220419500	IC.,LA6358
X1	5347001700	OSC.,CRYSTAL 8MHZ MC-18C

MOTHER PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200307200	MOTHER PCB ASSY
	*5200307210	MOTHER PCB ASSY(-20T ONLY)
	*5210307200	MOTER PCB
P1	5336330400	PLUG,CONN. 53025-0410
P2	5336330500	PLUG,CONN. 53025-0510
P3	5336330600	PLUG,CONN. 53025-0610
P4	5336330200	PLUG,CONN. 53025-0210
P5	5336330400	PLUG,CONN. 53025-0410
P6	5336330500	PLUG,CONN. 53025-0510
P7	5336330400	PLUG,CONN. 53025-0410
P8,9	5336330200	PLUG,CONN. 53025-0210
P10	5336330300	PLUG,CONN. 53025-0310 (-20T ONLY)
P11	5336330600	PLUG,CONN. 53025-0610 (-20T ONLY)
P12	5336212600	PLUG,CONN. 5089-6A
P13	5336330200	PLUG,CONN. 53205-0210 (-20T ONLY)
P14	5336330300	PLUG,CONN. 53025-0310
P101,201	5336279500	PLUG,CONN. IL-SDD-5P-S2T
P102,202	5336279600	PLUG,CONN. IL-SDD-6P-S2T
P103,203	5336279300	PLUG,CONN. IL-SDD-3P-S2T
P104,204	5336279800	PLUG,CONN. IL-SDD-8P-S2T
P105,205	5336279900	PLUG,CONN. IL-SDD-9P-S2T
P106,206	5336279900	PLUG,CONN. IL-SDD-9P-S2T
P107,207	5336279400	PLUG,CONN. IL-SDD-4P-S2T
P108,208	5336279400	PLUG,CONN. IL-SDD-4P-S2T
P301	5336279600	PLUG,CONN. IL-SDD-6P-S2T
P302	5336279800	PLUG,CONN. IL-SDD-8P-S2T
P303,304	5336279900	PLUG,CONN. IL-SDD-9P-S2T
P305,306	5336279400	PLUG,CONN. IL-SDD-4P-S2T
P401	5336279500	PLUG,CONN. IL-SDD-5P-S2T (-20T ONLY)
P402	5336279600	PLUG,CONN. IL-SDD-6P-S2T (-20T ONLY)
P403	5336279300	PLUG,CONN. IL-SDD-3P-S2T (-20T ONLY)
P404	5336279800	PLUG,CONN. IL-SDD-8P-S2T (-20T ONLY)
P405,406	5336279900	PLUG,CONN. IL-SDD-9P-S2T (-20T ONLY)
P407,408	5336279400	PLUG,CONN. IL-SDD-4P-S2T (-20T ONLY)
P501	5336279500	PLUG,CONN. IL-SDD-5P-S2T
P502	5336280000	PLUG,CONN. IL-SDD-10P-S2T
P503	5336279500	PLUG,CONN. IL-SDD- 5P-S2T
P504	5336279900	PLUG,CONN. IL-SDD-9P-S2T

Parts marked with *require longer delivery time.

OPERATION KEY PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200308700	OPERATION KEY PCB ASSY
	*5200308710	OPERATION KEY PCB ASSY (-20T ONLY)
	*5210308700	OPERATION KEY PCB
	*5801199600	SPACER,LED L=3.5
	*5801291200	SPACER,LED L=5.0
	*5787008300	SUPPORT,PCB RSPLS-10L
D1-5	5225022000	LED,SLP-135(RED)
D12,13	5225022000	LED,SLP-135(RED)
D14	5225022000	LED,SLP-135(RED) (-20T ONLY)
D18,19	5225022100	LED,SLP-235(GRN)
D27-58	5224015020	DIODE,1SS133T-77
D6,15	5225022000	LED,SLP-135(RED)
D7,16	5225022200	LED,SLP-435(YEL)
D8,17	5225022100	LED,SLP-235(GRN)
D9,10	5225022200	LED,SLP-435(YEL)
P10	5336341700	PLUG,CONN. S7B-PH-SM
S1-5	5300056300	SW.,PUSH 1-1 SKEUAC
S11	5300056300	SW.,PUSH 1-1 SKEUAC
S12-21	5302109600	SW.,TACT SKHHAR
S22-29	5302109700	SW.,TACT SKHCAC
S30	5302109700	SW.,TACT SKHCAC (-20T ONLY)
S31,32	5302109700	SW.,TACT SKHCAC
S6-10	5302109600	SW.,TACT SKHHAR
U5-7	5225018800	LED,GL7D201

OPERATION CPU PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200308600	OPERATION CPU PCB ASSY
	*5210308600	OPERATION CPU PCB
	*5317002100	PIN,DH CHECK IPS-1136
D21-26	5224015020	DIODE,1SS133T-77
P1	5336249600	PLUG,CONN. B06B-PH-K-S(WHT)
P2	5336250100	PLUG,CONN. B11B-PH-K-S(WHT)
P3-7	5336287200	PLUG,CONN. S2B-PH-K-S(WHT)
P8	5336287600	PLUG,CONN. S6B-PH-K-S(WHT)
R200	5242110400	R.,ARRAY 4.7KX6
R201	5242110600	R.,ARRAY 4.7KX8
R202	5242110200	R.,ARRAY 4.7KX4
U1	5220822900	MICROCOM.,UPD75004CU-073
U10	5220052600	IC.,TC74HC244P
U11-14	5232255720	TR.,DIGI. DTC124ES
U2	5232256900	TR.,ARRAY M54585P
U3	5220055900	IC.,TC74HC138P
U4	5232257600	TR.,ARRAY M54581P
U8 U9	5220052000	IC.,TC74HC32P
X1	5347012000	OSC,CERAMIC CST4.19MHZ

Parts marked with *require longer delivery time.

R/P AMPL PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200306900	R/P AMPL PCB ASSY
	*5200306910	R/P AMPL PCB ASSY(GAPLES)
	*5200306920	R/P AMPL PCB ASSY (-20T ONLY)
	*5210306900	R/P AMPL PCB
C101	5267206600	C.,TRIMMER 100P VCT51J
D1-2	5224015020	DIODE,1SS133T-77
D9	5224015020	DIODE,1SS133T-77
D10,11	5224015400	DIODE,1K60
D12	5224015020	DIODE,1SS133T-77
D13-15	5224015020	DIODE,1SS133T-77
D17	5224015020	DIODE,1SS133T-77
D19-22	5224015020	DIODE,1SS133T-77
J1	5336281500	SOCKET,CONN. 1L-SDD-5S
J2	5336281600	SOCKET,CONN. 1L-SDD-6S
J3	5336281300	SOCKET,CONN. 1L-SDD-3S
J4	5336281800	SOCKET,CONN. 1L-SDD-8S
J5,6	5336281900	SOCKET,CONN. 1L-SDD-9S
J7,8	5336281400	SOCKET,CONN. 1L-SDD-4S
K1	5290013900	RELAY,12V G6E-134P-US
K2	5290013700	RELAY,SY-12W-K
L1,2	5286007600	COIL,CHOKE 3.0MH J
L3	5286007700	COIL,CHOKE 3.3MH
L4	5320059500	TRANS.,ERASE
L5	5286007700	COIL,CHOKE 3.3MH
Q1-4	5232009500	FET,2SK170BL
Q11,12	5232008420	FET.,2SK381D
Q13,14	5232007920	FET.,2SJ-40(D)
Q15-17	5232008420	FET.,2SK381D
Q18	5232007920	FET.,2SJ-40(D)
Q19	5230775020	TR.,2SC2878-B
Q20	5232008420	FET.,2SK381D
Q21	5232007920	FET.,2SJ-40(D)
Q22,23	5232008420	FET.,2SK381D
Q24,25	5232007920	FET.,2SJ-40(D)
Q27-30	5232008420	FET.,2SK381D
Q31	5232008420	FET.,2SK381D
Q32	5232008420	FET.,2SK381D
Q33	5232007920	FET.,2SJ-40(D)
Q34-36	5232008420	FET.,2SK381D
Q38	5230780920	TR.,2SC2603F
Q39	5232007920	FET.,2SJ-40(D)(GAPLES)
Q41	5230782000	TR.,2SC2062B
Q44-46	5230782200	TR.,2SC2002L
Q5	5232008420	FET.,2SK381D
Q6,7	5232007920	FET.,2SJ-40(D)
Q8	5232008420	FET.,2SK381D
Q9,10	5232007920	FET.,2SJ-40(D)
R301,302	5280021100	R.,TRIMMER 4.7KB
R303-306	5280021000	R.,TRIMMER 3.3KB
R307	5280021900	R.,TRIMMER 100KB
R308	5280021100	R.,TRIMMER 4.7KB
R309	5280021700	R.,TRIMMER 47KB H.
R310-312	5280021300	R.,TRIMMER 10KB H.
R313	5280021200	R.,TRIMMER 6.8KB
R314	5280021900	R.,TRIMMER 100KB
TP1-3	5317002100	PIN,DH CHECK IPS-1136
TP5	5317002100	PIN,DH CHECK IPS-1136
U1-4	5220439600	IC.,UPC4570C
U5	5220418800	IC.,M5218P

R/P AMPL PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
U6	5232255720	TR.,DIGI. DTC124ES (NO GAPLES)
U7	5232254820	TR.,DIGI. DTA124ES
U9	5286037300	COIL,TRAP VARIABLE 145KHZ

AMP CONT PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200307300	AMP CONT PCB ASSY
	*5200307310	AMP CONT PCB ASSY(GAPLES)
	*5210307800	COIL PCB(GAPLES)
J1	5336281300	SOCKET,CONN. IL-SDD-3S
J2	5336281400	SOCKET,CONN. IL-SDD-4S
J3	5336281900	SOCKET,CONN. IL-SDD-9S
J4	5336281300	SOCKET,CONN. IL-SDD-3S
J5,6	5336281400	SOCKET,CONN. IL-SDD-4S
L101,201	5320059500	TRANS.,ERASE(GAPLES)
Q101,201	5230780920	TR.,2SC2603F(GAPLES)
Q102,202	5230782200	TR.,2SC2002L(GAPLES)
Q103,203	5230782200	TR.,2SC2002L(GAPLES)
Q104,204	5230782200	TR.,2SC2002L(GAPLES)
TP101,201	5317002100	PIN,DH CHECK IPS-1136 (GAPLES)
U1,2	5220019100	IC.,TC4011BP
U101,201	5232255720	TR.,DIGI. DTC124ES(GAPLES)
U11-13	5232255720	TR.,DIGI. DTC124ES
U14	5292210200	OSC,MODULE 145KHZ 30V
U15	5220419500	IC.,LA6358(GAPLES)
U3-10	5232254820	TR.,DIGI. DTA124ES

IN/OUT AMPL PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200307100	IN/OUT AMPL PCB ASSY
	*5210307100	IN/OUT AMPL PCB
J1	5330509500	JACK,4P YKC21-0062
J101,201	5334042200	SOCKET,XLR CONN. XLB3-31
L101,201	5286007700	COIL,CHOKE 3.3MH
P1	5122147000	PLUG,CONN. 5046-04A(WHT)
P101,102	5334042100	PLUG,XLR CONN. XLB3-32
P2	5122455000	PLUG,CONN. 5046-04A(RED)
P3	5122145000	PLUG,CONN. 5046-02A(WHT)
P5	5336107300	PLUG,CONN. 5045-03A(YEL)
P6	5122183000	PLUG,CONN. 5045-02F(BLK)
Q101,102	5230775020	TR.,2SC2878-B
U1	5220439600	IC.,UPC4570C
U101,201	5220439600	IC.,UPC4570C
U102,202	5220433500	IC.,NJM5532DD
U103,203	5242127400	R.,ARRAY RMHZ6 648
U104,204	5242117800	R.,ARRAY RMN Z8178

CAPSTAN SERVO PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200308100	CAPSTAN SERVO PCB ASSY
	*5210308100	CAPSTAN SERVO PCB
	*5317002100	PIN,DH CHECK IPS-1136
D1-2	5224015020	DIODE,1SS133T-77
P1	5122129000	PLUG,CONN. 5045-05A(WHT)
P2	5122128000	PLUG,CONN. 5045-04A(WHT)
P3	5336249600	PLUG,CONN. B06B-PH-K(WHT)
Q1-3	5230778320	TR.,2SC2320F
Q5-8	5232255720	TR.,DIGI. DTC124ES
R29	⚠ 5184550000	R.,INCOMBUS. 2W 1.0 OHM J
R40	5242110200	R.,ARRAY 4.7KX4
R50	5280216100	R.,TRIMMER 10KB
R51	5280216100	R.,TRIMMER 10KB
R52	5280216100	R.,TRIMMER 10KB
U1,2	5220013400	IC.,TC4066BP
U3	5220019100	IC.,TC4011BP
U4	5220019000	IC.,TC4001BP
U5	5220426600	IC.,UPC1043C
U6	5220419500	IC.,LA6358,
U7	5220092600	IC,NJM4151D

N FILTER PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200309600	N FILTER PCB ASSY [J,US,C,GE]
	*5200309700	N FILTER PCB ASSY[E,UK,A]
	*5210309600	N FILTER PCB[J,US,C,GE]
	*5210309700	N FILTER PCB[E,UK,A]
	*5555590000	PLATE(A),EARTH
	*5327007200	TERMINAL,2P
C1,2	⚠ 5267704000	SPARK KILL.,0.0047UF 250V
C3,4	⚠ 5267703800	SPARK KILL.,4700PF 400V
C5-8	⚠ 5267703800	SPARK KILL.,4700PF 400V [E,UK,A]
L1	⚠ 5292806300	FILTER,NOISE FK0B16MH13
P1	5334074300	PLUG,CONN. 2P RTB-1,5-2V
P2	5334074400	PLUG,CONN. 3P RTB-1,5-3V

[US]:U.S.A. [E]:EUROPE [UK]:U.K. [C]:CANADA
[J]:JAPAN [GE]:GENERAL EXPORT [A]:AUSTRALIA

Parts marked with *require longer delivery time.

PS PCB ASSY

REF.NO.		PARTS NO.	DESCRIPTION
		*5200306500	PS PCB ASSY[J,US,C,GE]
		*5200306600	PS PCB ASSY[E,UK,A]
		*5210306500	PS PCB[J,US,CGE]
		*5210306600	PS PCB[E,UK,A]
		*5041237000	HOLDER,FUSE[J,US,C,GE]
		*5332014200	HOLDER,FUSE[E,UK,A]
		*5801379800	HEATSINK(B)
		*5033291000	PLATE,INSULATE
		*5033295000	TUBE,INSULATE
		*5780003006	SCREW,BIND M3X6
		*5780003008	SCREW,BIND M3X8
C1,2	⚠	5263164500	C.,METAL 0.047UF/250V [E,UK,A]
C3,4	⚠	5260466310	C.,ELEC. 2200UF/35V
C5,6	⚠	5260463910	C.,ELEC. 220UF/35V
C14,15	⚠	5260466310	C.,ELEC. 2200UF/35V
C16,17	⚠	5263167923	C.,METAL 0.10UF/50V
C25,26	⚠	5263164500	C.,METAL 0.047UF/250V [E,UK,A]
C27	⚠	5260467310	C.,ELEC. 4700UF/25V
C28	⚠	5262015600	C.,ELEC. 6800UF/35V
C31	⚠	5260461120	C.,ELEC. 1UF/50V
C37	⚠	5260467310	C.,ELEC. 4700UF/25V
D1-8	⚠	5224013210	DIODE,DS135D FA4 FF
D9,10		5224015700	DIODE,1SS130
D11		5224589321	DIODE,ZENER RD15ESB2 FT
D13	⚠	5228010000	SILICON STACK,D5SB20
D14		5224014700	DIODE,S3V20H
D15,16		5224015020	DIODE,1SS133T-77
D17		5224585621	DIODE,ZENER RD6.2ESB1 FT
D18		5224589021	DIODE,ZENER RD 13ESB3 FT
D19	⚠	5224013210	DIODE,DS135D FA4 FF
D20		5224015020	DIODE,1SS133T-77
F1 F2	⚠	5307004300	FUSE,3A-250V[J,US,C,GE]
	⚠	5142190000	FUSE,2.5A-250V[E,UK,A]
F3 F4	⚠	5307046200	FUSE,10A-250V[J,US,C,GE]
	⚠	5142194000	FUSE,6.3A-250V[E,UK,A]
P1		5334074700	PLUG,CONN. 6P RTB-1,5-6V
Q1	⚠	5231762800	TR.,2SD1913R
Q2	⚠	5230509700	TR.,2SB1274R
Q3	⚠	5145165000	TR.,2SD-7160
Q4		5230780920	TR.,2SC2603F
Q5	⚠	5145087000	TR.,2SD-313E
Q6		5230780920	TR.,2SC2603F
R1,2	⚠	5184249000	R.,INCOMBUSTIBLE 100 OHM
R9,10	⚠	5184217000	R.,INCOMBUSTIBLE 4.7 OHM
U1		5220425800	IC.,M5230LA
U2	⚠	5220434900	IC.,M5F7815L
U3	⚠	5220435800	IC.,M5F7915L
U4,7		5232255720	TR.,DIGI. DTC124ES
U5		5220418800	IC.,M5218P
U6	⚠	5220434400	IC.,M5F7805L

VR PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200307500	VR PCB ASSY
	*5210307500	VR PCB
	*5801336200	SPACER,LED
D1	5225022000	LED.,SLP-135(RED)
D2	5225022100	LED.,SLP-235(GRN)
D3	5225022200	LED.,SLP-435(YEL)
D4	5225022200	LED.,SLP-435(YEL)
D5	5225022100	LED.,SLP-235(GRN)
D101-104	5224015020	DIODE,1SS133T-77
D201-204	5224015020	DIODE,1SS133T-77
P101 P201	5336330800	PLUG,CONN. 53025-0810
P102 P202	5336330200	PLUG,CONN. 53025-0210
P301	5336330400	PLUG,CONN. 53025-0410
P302	5336330600	PLUG,CONN. 53025-0610
P303	5336330200	PLUG,CONN. 53025-0210
Q101,201	5232008420	FET.,2SK381D
Q102,202	5232007920	FET.,2SJ-40(D)
Q103,203	5232008420	FET.,2SK381D
Q104,204	5232007920	FET.,2SJ-40(D)
R1-4	5282022600	VR.,20KA 1S1UVR 11
R5	5282023400	VR.,1S1UVR 11 20KB 10%
S1-4	5300917300	SW.,SLIDE 1-2 N SSSU01

PHONE AMPL PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200307400	PHONE AMPL PCB ASSY
	*5200307410	PHONE AMPL PCB ASSY (-20T ONLY)
	*5210307400	PHONE AMPL PCB
	*5801336200	SPACER,LED
	*5730039400	SPACER,LED(-20T ONLY)
D1,2	5224015020	DIODE,1SS133T-77
D3,4	5225022000	LED.,SLP-135(RED)
D5	5225022100	LED.,SLP-235(GRN) (-20T ONLY)
D101,201	5224015320	DIODE,MC931
P1	5336287500	PLUG,CONN. S5B-PH-K-S(WHT)
P2	5336287300	PLUG,CONN. S3B-PH-K-S(WHT)
P3	5336287400	PLUG,CONN. S4B-PH-K-S(WHT)
P4	5336287200	PLUG,CONN. S2B-PH-K-S(WHT)
P5	5336287600	PLUG,CONN. S6B-PH-K-S(WHT)
P6	5336291400	PLUG,CONN. S4B-PH-K-R(RED)
Q101,201	5230773800	TR.,2SC2655-Y
Q102,202	5230014000	TR.,2SA1020-Y
R106,206 ⚠	5183542000	R.,INCOMB. 3.3 OHM J FR
R107,207 ⚠	5183542000	R.,INCOMB. 3.3 OHM J FR
U1	5220439600	IC.,UPC4570C

[US]:U.S.A. [E]:EUROPE [UK]:U.K. [C]:CANADA [J]:JAPAN
[GE]:GENERAL EXPORT [A]:AUSTRALIA

Parts marked with *require longer delivery time.

SPEED SW PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200308800	SPEED SW PCB ASSY
	*5210308800	SPEED SW PCB
D59,60	5224015020	DIODE,1SS133T-77
S33,34	5302109700	SW.,TACT SKHCAC

PHONE VR PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200308900	PHONE VR PCB ASSY
	*5210308900	PHONE VR PCB
R3	5282417500	VR.,50KAX2 1S2UVR 14

JACK PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200307900	JACK PCB ASSY
	*5210307900	JACK PCB
J1	5330011400	JACK,3P B11-5005
P1	5336126300	PLUG,CONN. 8263-0312(WHT)
R1,2	5181986000	R.,1NCOMB. 33

JOINT PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200308500	JOINT PCB ASSY
	*5210308500	JOINT PCB
	*5801379300	HEETSINK(A)
	*5780003008	SCREW,BIND M3X8
D1-3	5224013200	DIODE,DS135D FR
P1	5336288000	PLUG,CONN. S10B-PH-K(WHT)
P2	5122148000	PLUG,CONN. 5045-05A(WHT)
P3,4	5336202300	PLUG,CONN. 5483-03A(WHT)
P5-8	5336202200	PLUG,CONN. 5483-02A(WHT)
P9	5336287400	PLUG,CONN. S4B-PH-K(WHT)
P10	5336287500	PLUG,CONN. S5B-PH-K-S(WHT)
P11	5336249300	PLUG,CONN. B03B-PH-K(WHT)
P12	5336249600	PLUG,CONN. B06B-PH-K(WHT)
P13	5336249400	PLUG,CONN. B04-PH-K-S(WHT)
Q1,2	5231758800	TR.,2SD1047-E
R1 R2	⚠ 5185202000	R.,METAL PLATE 0.47 5W

SENSOR L PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200308200	SENSOR L PCB ASSY
	*5210308200	SENSOR L PCB
	*5801138800	SPACER,SENSOR COIL
D1	5224015010	DIODE,1SS133HV
L1,2	5160038000	COIL,DETECTOR
P1	5336287300	PLUG,CONN. S3B-PH-K(WHT)
Q1	5145036000	TR.,2SC-945LK

SENSOR R PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200308300	SENSOR R PCB ASSY
	*5210308300	SENSOR R PCB
	*5801138800	SPACER,SENSOR COIL
D1	5224015010	DIODE,1SS133HV
L1,2	5160038000	COIL,DETECTOR
P1	5336287600	PLUG,CONN. S6B-PH-K-S(WHT)
Q1	5145036000	TR.,2SC-945LK
U1	5228016500	PHOTO INTERRUPTER,SPI-216

PG PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200308400	PG PCB ASSY
	*5210308400	PG PCB
P1	5336287400	PLUG,CONN. S4B-PH-K-S(WHT)
U1 U2	13419359	PHOTOELECTRON,GP2S06

TRANSISTOR PCB ASSY

REF.NO.	PARTS NO.	DESCRIPTION
	*5200310800	TRANSISTOR PCB ASSY
	*5210310800	TRANSISTOR PCB
Q4	5231762800	TR.,2SD1913R

Parts marked with *require longer delivery time.

TC AMPL PCB ASSY(-20T ONLY)

REF.NO.	PARTS NO.	DESCRIPTION
	*5200307000	TC AMPL PCB ASSY
	*5210307000	TC AMPL PCB
	*5210310900	COIL A PCB
	*5210311000	COIL B PCB
C53	5267206200	C.,TRIMMER 100PF CTZ-53
D1-9	5224015020	DIODE,1SS133T-77
J1	5336281300	SOCKET,CONN. IL-SDD-3S
J2	5336281600	SOCKET,CONN. IL-SDD-6S
J3	5336281300	SOCKET,CONN. IL-SDD-3S
J4	5336281800	SOCKET,CONN. IL-SDD-8S
J5	5336281400	SOCKET,CONN. IL-SDD-4S
J6	5336281300	SOCKET,CONN. IL-SDD-3S
J7,8	5336281400	SOCKET,CONN. IL-SDD-4S
K1	5290012700	RELAY,12V G5A-237PL
K2,3	5290013900	RELAY,12V G6E-134P-US
L1	5286007600	COIL,CHOKE 3.0MH J
L2	5286007700	COIL,CHOKE 3.3MH J
L4	5320059600	TRANS.,ERASE TC
Q1	5232007920	FET.,2SJ-40(D)
Q2	5232008420	FET.,2SK-381 D
Q3	5232007920	FET.,2SJ-40(D)
Q5	5232008420	FET.,2SK-381 D
Q6	5232007920	FET.,2SJ-40(D)
Q7	5232008420	FET.,2SK-381 D
Q8,9	5230782200	TR.,2SC2002L
Q10	5232008420	FET.,2SK-381 D
Q11	5230782000	TR.,2SC2062 B
Q12	5232008420	FET.,2SK-381 D
Q13	5232007920	FET.,2SJ-40(D)
R201	5242117800	R.,ARRAY RMN Z8178
R101	5280036900	R.,TRIMMER 100KB
R102	5280036300	R.,TRIMMER 10KB
R103,104	5280035700	R.,TRIMMER 1KB
R105	5280036900	R.,TRIMMER 100KB
R106	5280035700	R.,TRIMMER 1KB
R107	5280036900	R.,TRIMMER 100KB
R108	5280035700	R.,TRIMMER 1KB
R109	5280036900	R.,TRIMMER 100KB
R111	5280036700	R.,TRIMMER 47KB
R112	5280035900	R.,TRIMMER 2.2KB
R113	5280036700	R.,TRIMMER 47KB
R114	5280035900	R.,TRIMMER 2.2KB
TP1-7	5317002100	PIN,DH CHECK IPS-1136
U1-4	5220439600	IC.,UPC4570C
U5	5220433500	IC.,NJM5532D-D
U7,8	5232255720	TR.,DIGI DTC124ES
U9,10	5232254820	TR.,DIGI DTA124ES
U12	5232254820	TR.,DIGI DTA124ES
U13	5286037300	COIL,TRAP(145KHz)

SPEAKER SW PCB ASSY[BR-20N(US,C,J),-20T(J)]

REF.NO.	PARTS NO.	DESCRIPTION
	*5200310600	SPEAKER SW PCB ASSY [US,C,J]
	*5210310600	SPEAKER SW PCB[US,C,J]
P1	5336287300	PLUG,CONN. S3B-PH-K-S(WHT) [US,C,J]
S1	5300917700	SW.,SLIDE 1-3 SSSS92 [US,C,J]

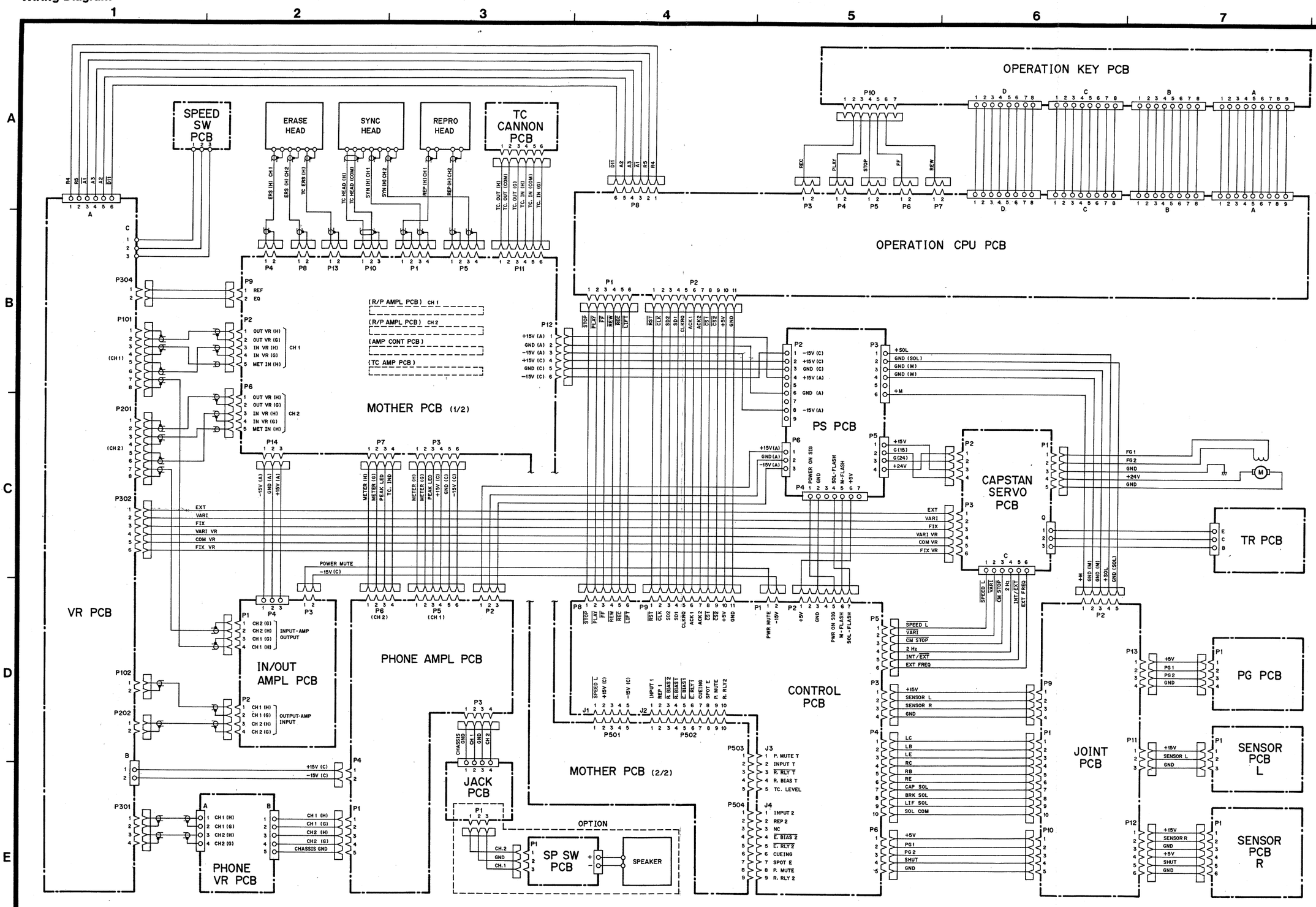
TC IN/OUT PCB ASSY(-20T ONLY)

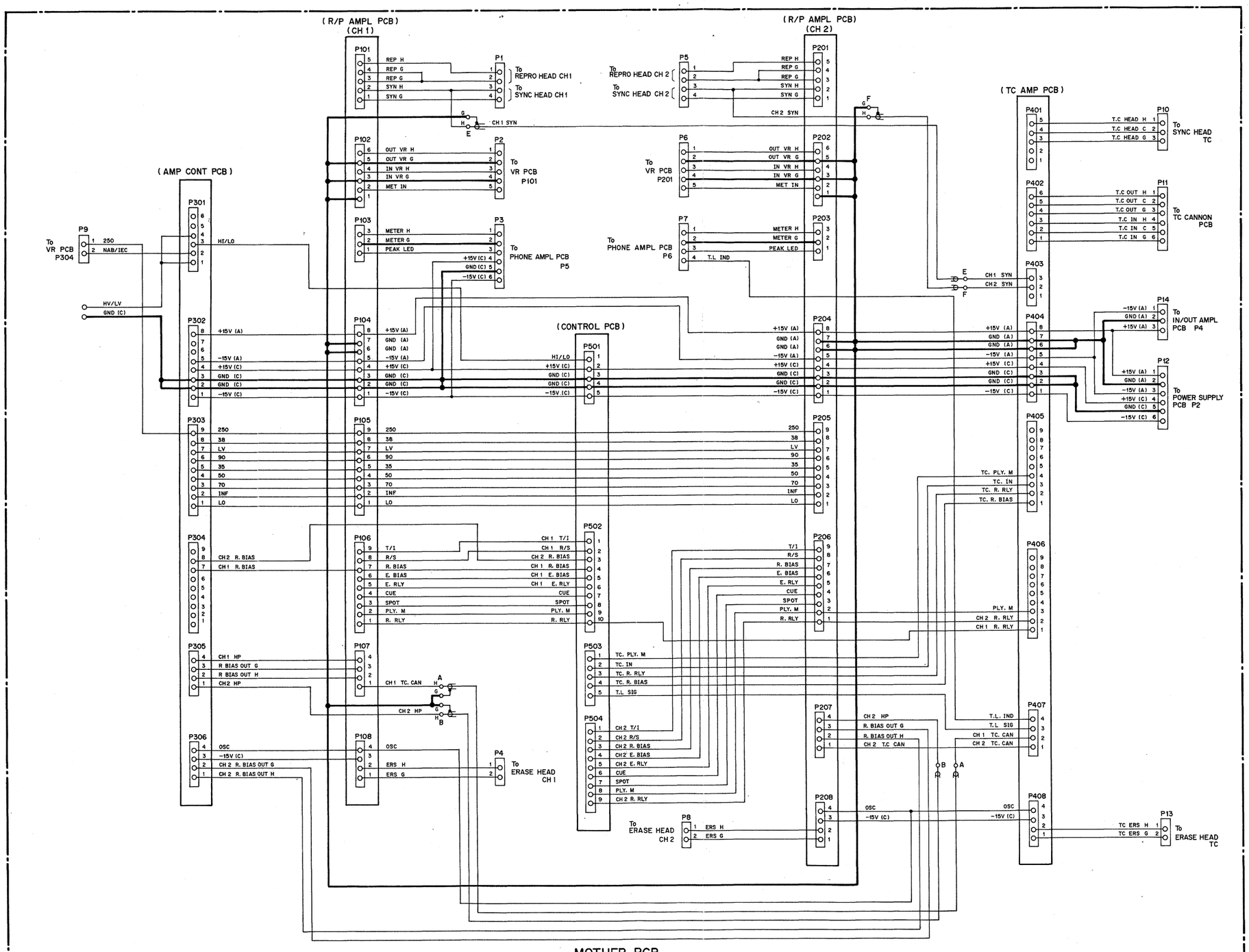
REF.NO.	PARTS NO.	DESCRIPTION
	*5200307600	TC IN/OUT PCB ASSY
	*5210307600	TC IN/OUT PCB
J1	5334042200	SOCKET,XLR CONN. XLB3-31
P1	5334042100	PLUG,XLR CONN. XLB3-32
P2	5122130000	PLUG,CONN. 5045-06A(WHT)

[US]:U.S.A. [E]:EUROPE [UK]:U.K. [C]:CANADA [J]:JAPAN
[GE]:GENERAL EXPORT [A]:AUSTRALIA

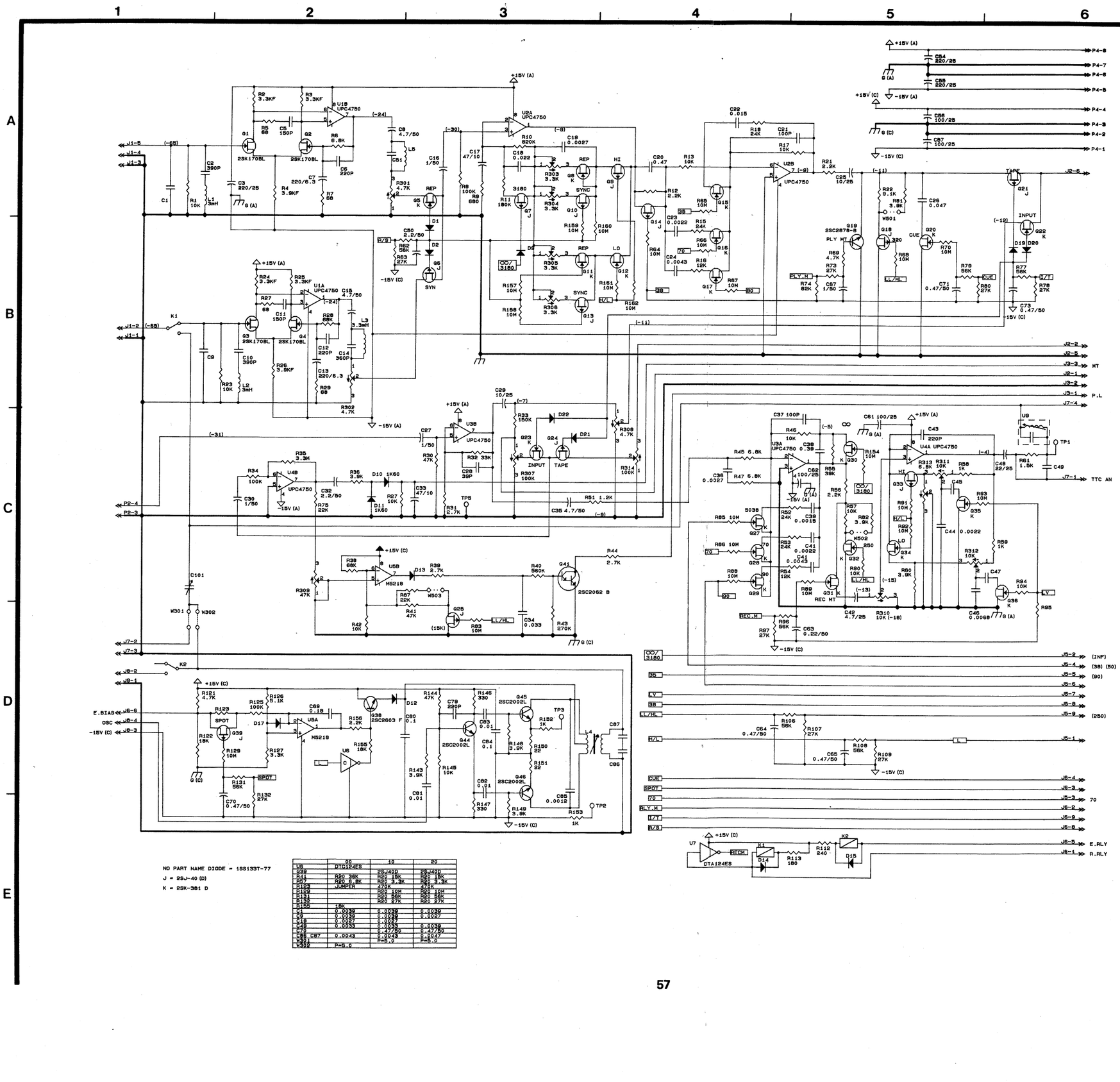
Parts marked with *require longer delivery time.

8-3. Schematic Drawings
Wiring Diagram

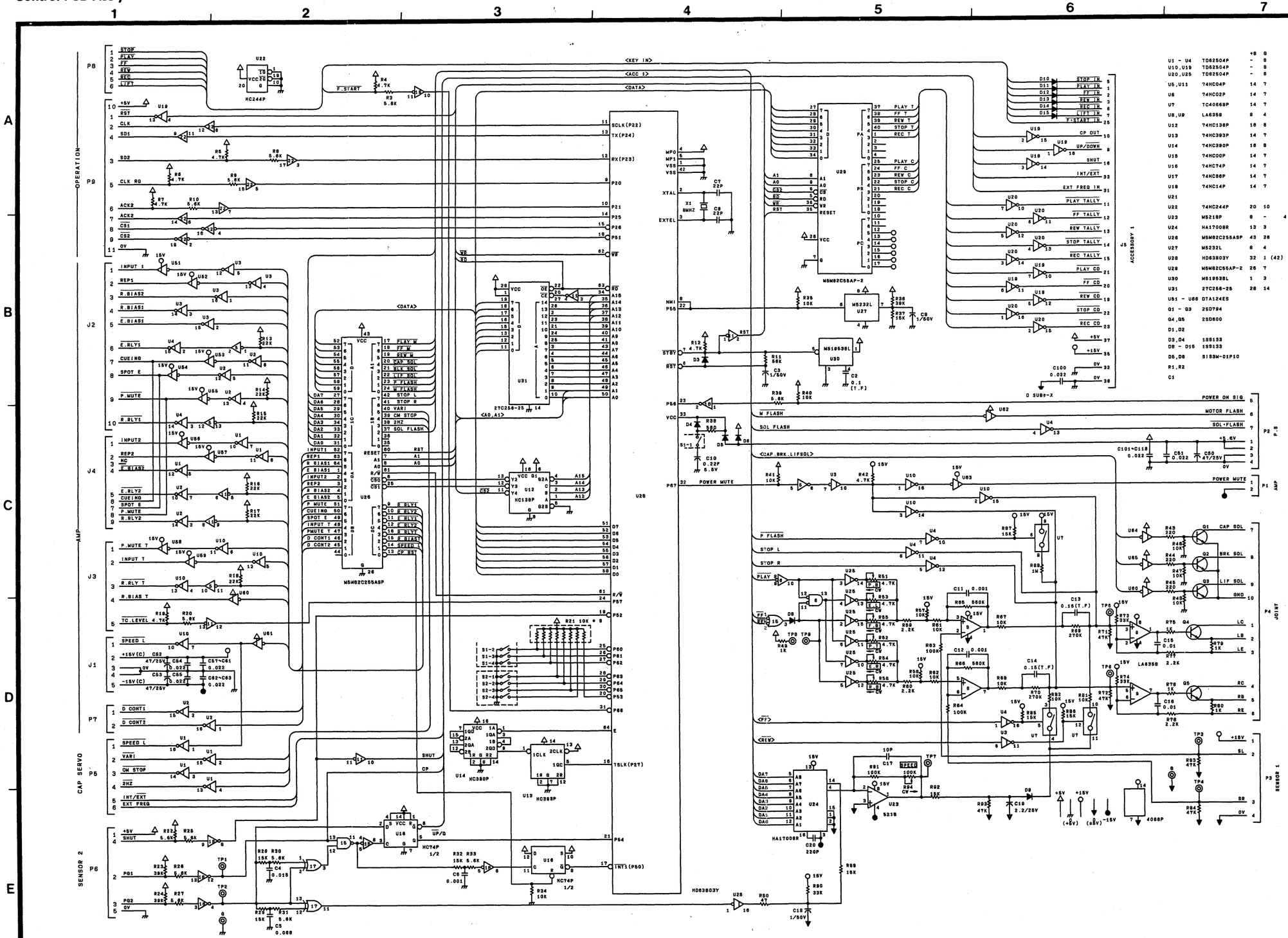


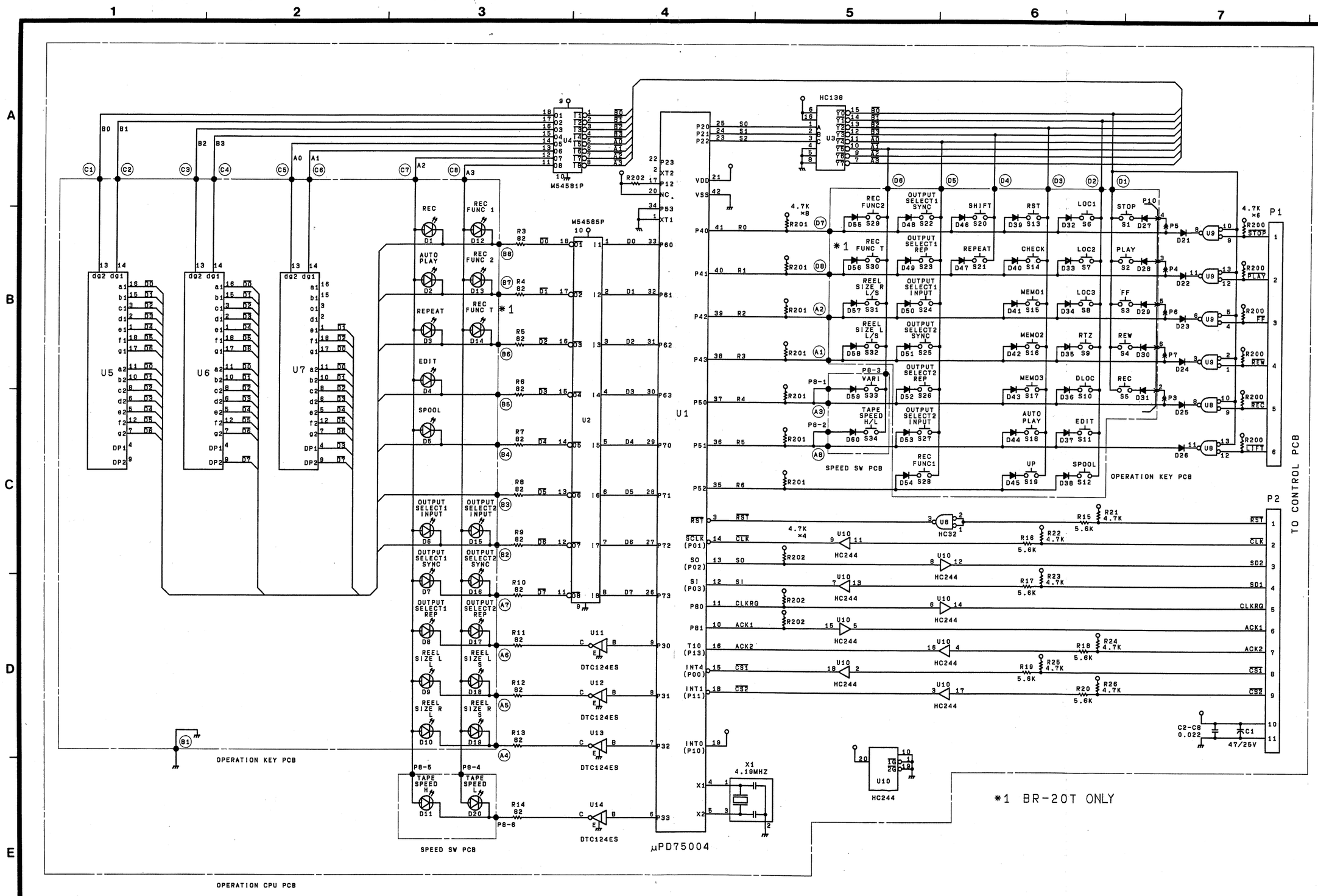

(R/P AMPL PCB) (CH 1)
(R/P AMPL PCB) (CH 2)
(TC AMP PCB)
(AMP CONT PCB)
(CONTROL PCB)
P101
P102
P103
P104
P105
P106
P107
P108
P201
P202
P203
P204
P205
P206
P207
P208
P301
P302
P303
P304
P305
P306
P401
P402
P403
P404
P405
P406
P407
P408
P501
P502
P503
P504
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
P13
P14
REP H
REP G
SYN H
SYN G
OUT VR H
OUT VR G
IN VR H
IN VR G
MET IN
METER H
METER G
PEAK LED
T.L IND
250
38
LV
90
35
50
70
INF
LO
T/I
R/S
R. BIAS
E. BIAS
E. RLY
CUE
SPOT
PLY. M
R. RLY
OSC
ERS H
ERS G
HI/LO
NAB/IEC
CH1 SYN
CH2 SYN
CH1 T/I
CH2 T/I
CH1 R/S
CH2 R/S
CH1 R. BIAS
CH2 R. BIAS
CH1 E. BIAS
CH2 E. BIAS
CH1 E. RLY
CH2 E. RLY
CH1 HP
CH2 HP
CH1 TC. CAN
CH2 TC. CAN
R BIAS OUT G
R BIAS OUT H
TC. PLY. M
TC. IN
TC. R. RLY
TC. R. BIAS
T.L SIG
T.C HEAD H
T.C HEAD C
T.C HEAD G
T.C OUT H
T.C OUT C
T.C OUT G
T.C IN H
T.C IN C
T.C IN G
+15V (A)
GND (A)
-15V (A)
+15V (C)
GND (C)
-15V (C)
HV/LV
GND (C)
To REPRO HEAD CH1
To SYNC HEAD CH1
To REPRO HEAD CH 2
To SYNC HEAD CH 2
To VR PCB P101
To VR PCB P201
To PHONE AMPL PCB P5
To PHONE AMPL PCB P6
To VR PCB P304
To ERASE HEAD CH1
To ERASE HEAD CH 2
To SYNC HEAD TC
To TC CANNON PCB
To IN/OUT AMPL PCB P4
To POWER SUPPLY PCB P2
To ERASE HEAD TC
MOTHER PCB

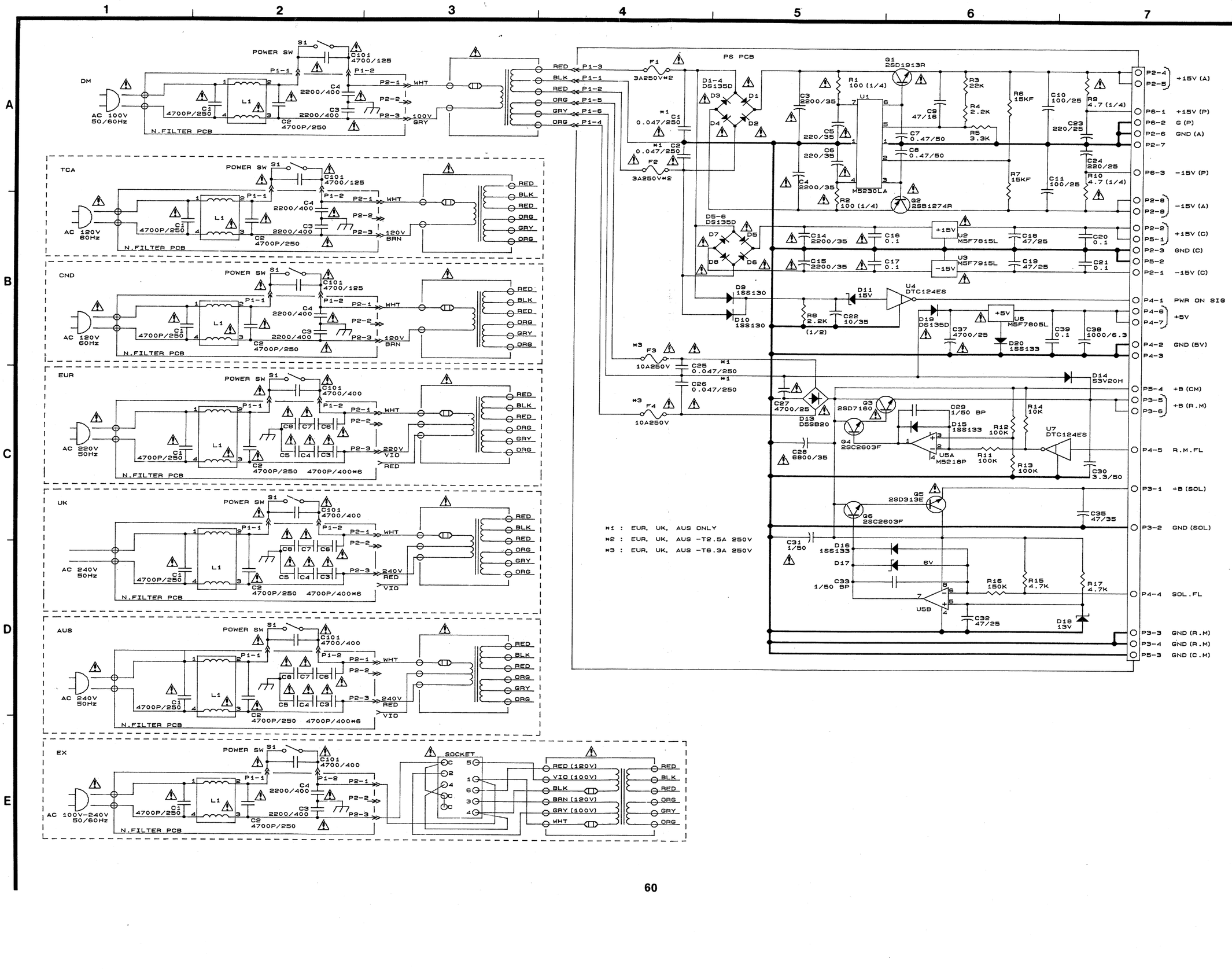
R/P AMPL PCB Ass'y

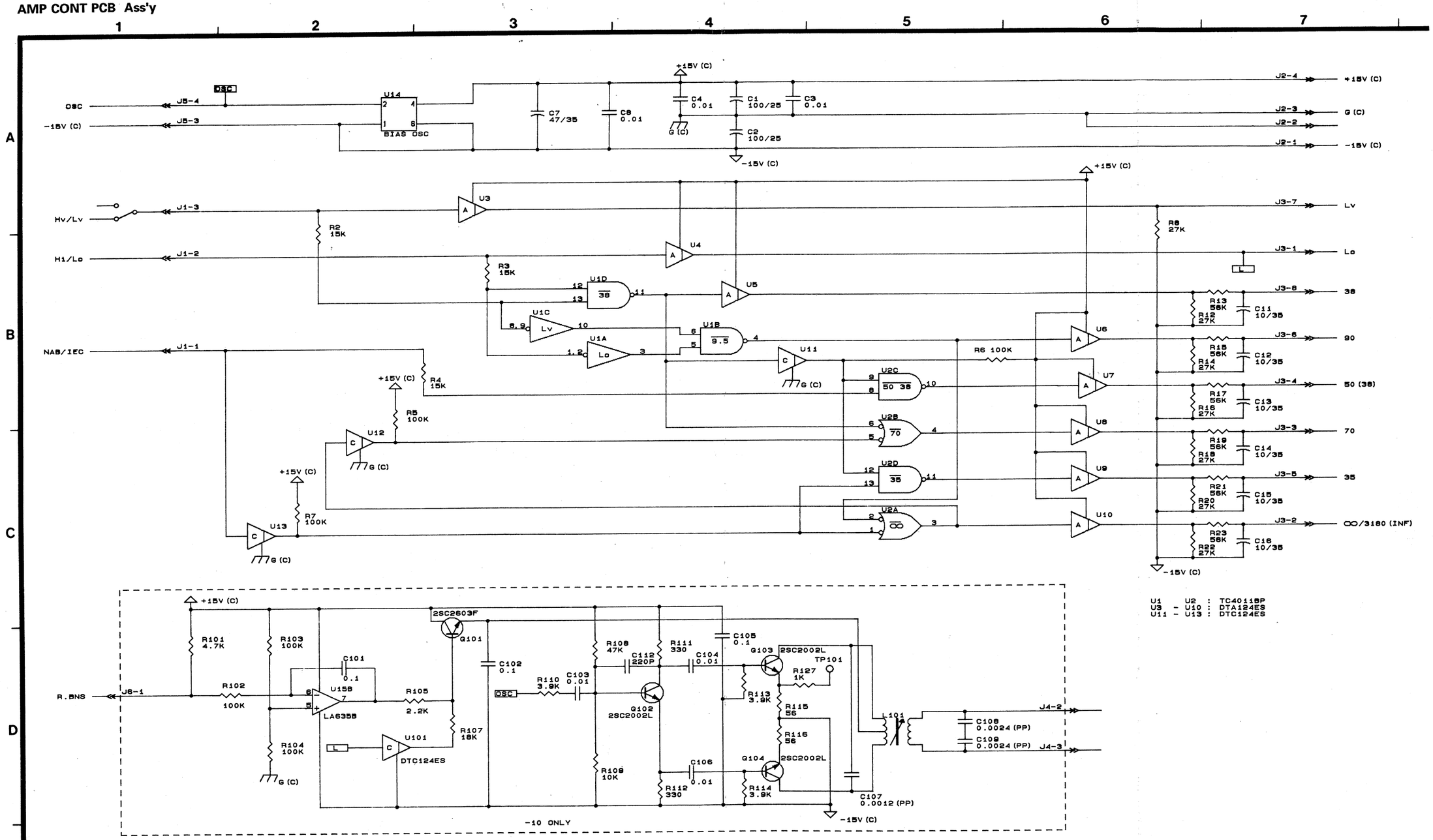

1
2
3
4
5
6
7
A
B
C
D
E
+15V (A)
-15V (A)
+15V (C)
-15V (C)
G (A)
G (C)
P4-8
P4-7
P4-6
P4-5
P4-4
P4-3
P4-2
P4-1
J2-6
J2-2
J2-5
J3-3 MT
J2-1
J3-2
J3-1 P.L
J7-4
J7-1 TTC ANT
J1-5
J1-4
J1-3
J1-2
J1-1
P2-4
P2-3
J7-2
J7-3
J8-2
J8-1
J6-6 E.BIAS
J6-4 OSC
J8-3
J5-2 (INF)
J5-4 (38) (50)
J5-5 (90)
J5-6
J5-7
J5-8
J5-9 (250)
J5-1
J6-4
J6-3
J5-3 70
J6-2
J6-9
J6-8
J8-5 E.RLY
J8-1 R.RLY
K1
K2
TP1
TP2
TP3
TP5
U1A UPC4750
U2A UPC4750
U2B UPC4750
U3A UPC4750
U4A UPC4750
U4B UPC4750
U5A M5218
U5B M5218
U6 C
U7 DTA124ES
U8A UPC4750
U8B UPC4750
U9
Q1 2SK170BL
Q2 2SK170BL
Q3 2SK170BL
Q4 2SK170BL
Q5 K
Q6 J
Q7 J
Q8 K
Q9 J
Q10 J
Q11 K
Q12 K
Q13 J
Q14 J
Q15 K
Q16 K
Q17 K
Q18 J
Q19 2SC2878-G
Q20 K
Q21 J
Q22 K
Q23 K
Q24 J
Q25 2SC2603 F
Q26 2SC2002L
Q27 2SC2002L
Q28 2SC2002L
Q29 K
Q30 K
Q31 K
Q32 K
Q33 J
Q34 K
Q35 K
Q36 K
Q38 2SC2603 F
Q39 J
Q41 2SC2062 B
D1
D2
D10 1K60
D11 1K60
D12
D13 2.7K
D14
D15
D17
D19 D20
D21
D22
W301
W302
W501
W502
W503
L1 3mH
L2 3mH
L3 3.3mH
L4
L5
L6
L7
L8
L9
L10
L11
L12
L13
L14
L15
L16
L17
L18
L19
L20
L21
L22
L23
L24
L25
L26
L27
L28
L29
L30
L31
L32
L33
L34
L35
L36
L37
L38
L39
L40
L41
L42
L43

Control PCB Ass'y



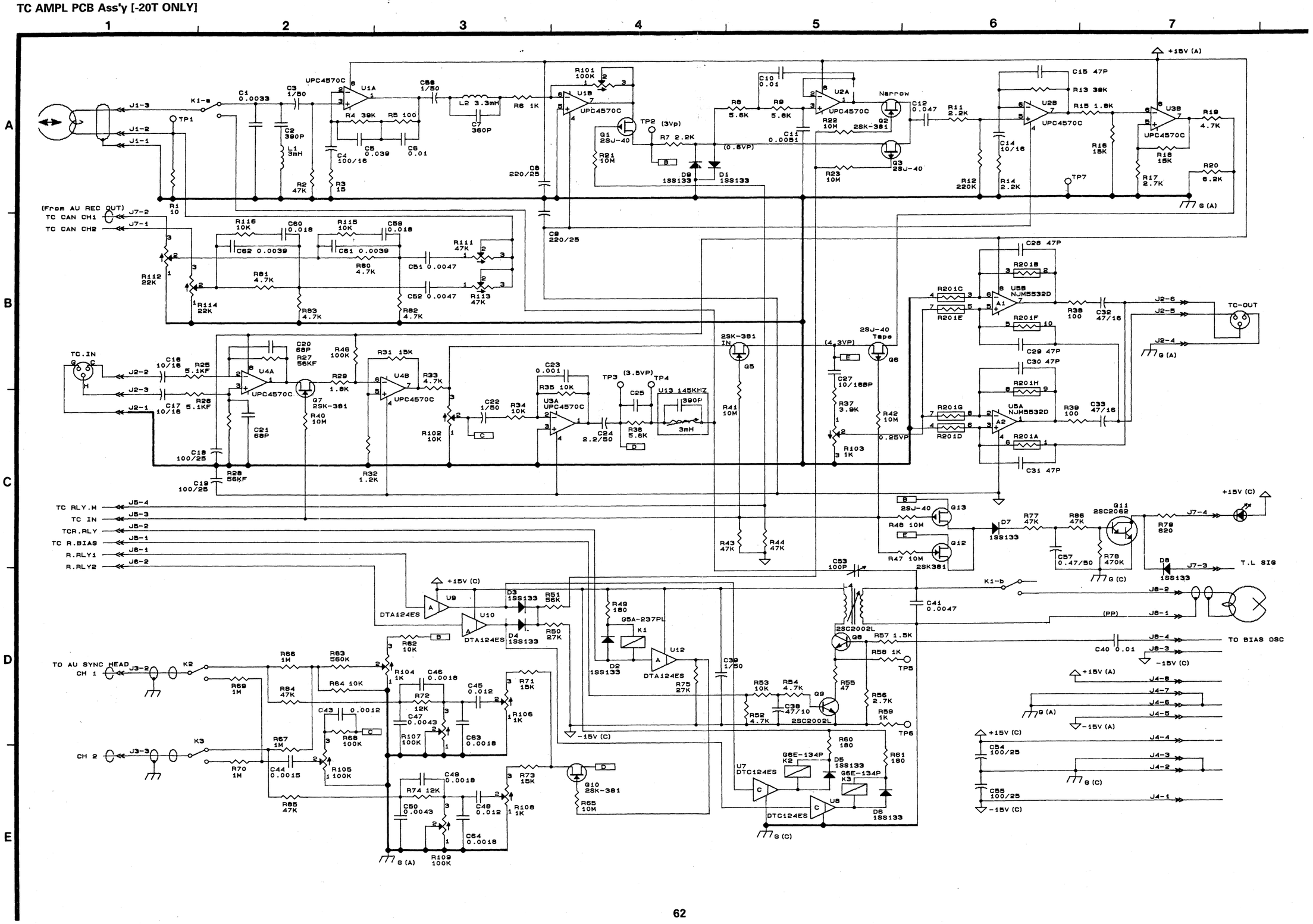

1
2
3
4
5
6
7
A
B
C
D
E
M54581P
M54585P
HC138
REC
REC FUNC 1
AUTO PLAY
REC FUNC 2
REPEAT
REC FUNC T
EDIT
SPOOL
OUTPUT SELECT1 INPUT
OUTPUT SELECT2 INPUT
OUTPUT SELECT1 SYNC
OUTPUT SELECT2 SYNC
OUTPUT SELECT1 REP
OUTPUT SELECT2 REP
REEL SIZE L L
REEL SIZE L S
REEL SIZE R L
REEL SIZE R S
TAPE SPEED H
TAPE SPEED L
DTC124ES
μPD75004
X1 4.19MHZ
HC244
HC32
4.7K ×8
4.7K ×4
5.6K
REC FUNC2
REC FUNC T
REEL SIZE R L/S
REEL SIZE L L/S
P8-3 VARI
TAPE SPEED H/L
P8-1
P8-2
REC FUNC1
OUTPUT SELECT1 SYNC
OUTPUT SELECT1 REP
OUTPUT SELECT1 INPUT
OUTPUT SELECT2 SYNC
OUTPUT SELECT2 REP
OUTPUT SELECT2 INPUT
SHIFT
REPEAT
RST
CHECK
MEMO1
MEMO2
MEMO3
AUTO PLAY
UP
LOC1
LOC2
LOC3
RTZ
DLOC
EDIT
SPOOL
STOP
PLAY
FF
REW
REC
LIFT
SPEED SW PCB
OPERATION KEY PCB
OPERATION CPU PCB
TO CONTROL PCB
C2-C8 0.022
C1 47/25V
*1 BR-20T ONLY

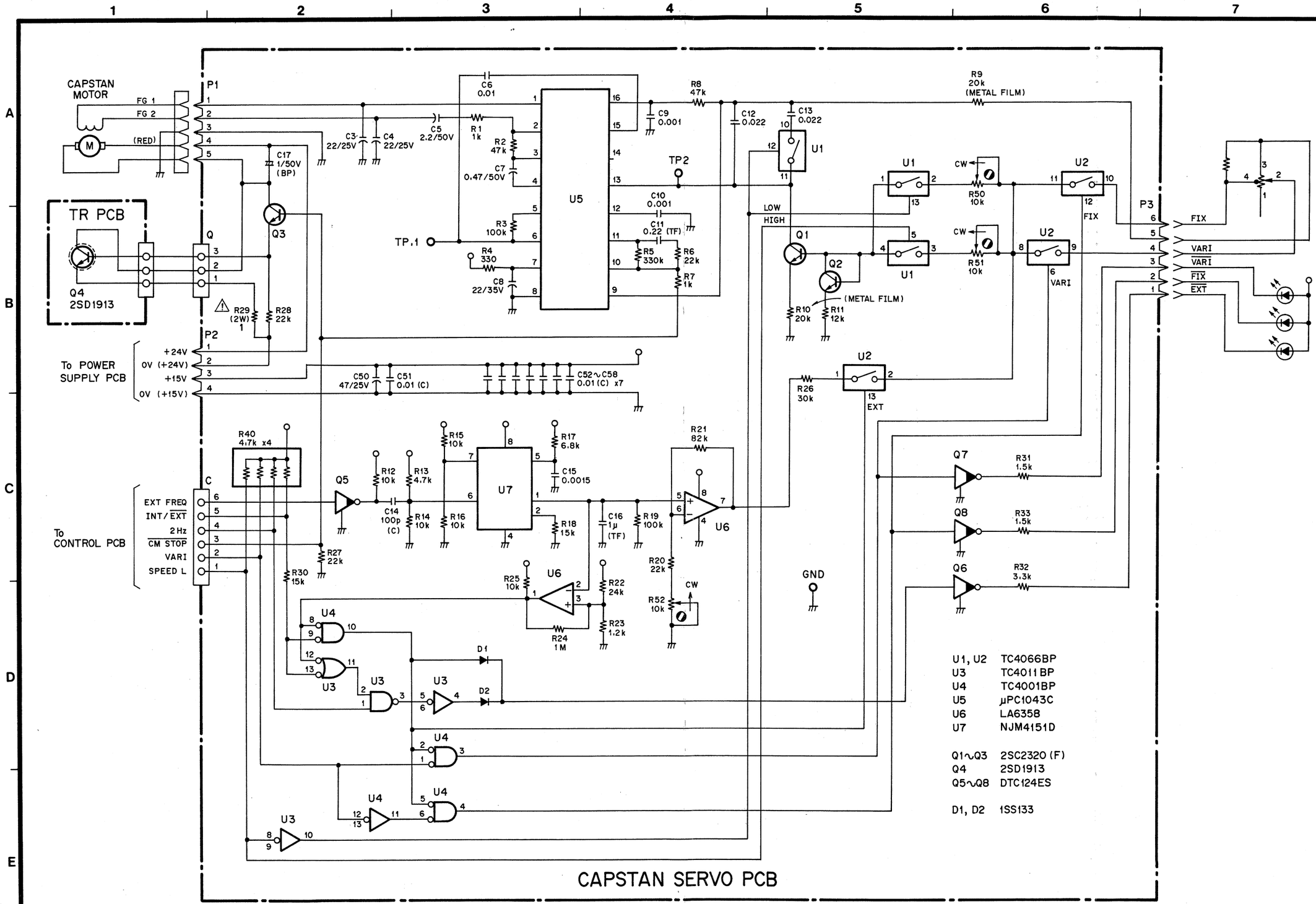

1
2
3
4
5
6
7
A
B
C
D
E
DM
POWER SW
S1
C101 4700/125
P1-1
P1-2
P2-1
WHT
P2-2
P2-3
100V GRY
C4 2200/400
C3 2200/400
C1 4700P/250
C2 4700P/250
L1
AC 100V 50/60Hz
N.FILTER PCB
TCA
AC 120V 60Hz
120V BRN
CND
EUR
C101 4700/400
AC 220V 50Hz
220V VIO
RED
C6 C7 C8
C5 C4 C3
4700P/250 4700P/400*6
UK
AC 240V 50Hz
240V RED
VIO
AUS
EX
SOCKET
AC 100V-240V 50/60Hz
RED (120V)
VIO (100V)
BLK
BRN (120V)
GRY (100V)
WHT
BLK
RED
ORG
GRY
ORG
RED
BLK
RED
ORG
GRY
ORG
PS PCB
RED P1-3
BLK P1-1
RED P1-2
ORG P1-5
GRY P1-6
ORG P1-4
F1 3A250V*2
F2 3A250V*2
F3 10A250V
F4 10A250V
*1 C1 0.047/250
*1 C2 0.047/250
*3 C25 0.047/250
*3 C26 0.047/250
D1-4 DS135D
D5-6 DS135D
D7 D8
D9 1SS130
D10 1SS130
D11 15V
D13 DSSB20
D14 S3V20H
D15 1SS133
D16 1SS133
D17
D18 13V
D19 DS135D
D20 1SS133
Q1 2SD1913R
Q2 2SB1274R
Q3 2SD716O
Q4 2SC2603F
Q5 2SD313E
Q6 2SC2603F
U1 M5230LA
U2 M5F7815L
U3 M5F7915L
U4 DTC124ES
U5A M5218P
U5B
U6 M5F7805L
U7 DTC124ES
R1 100 (1/4)
R2 100 (1/4)
R3 22K
R4 2.2K
R5 3.3K
R6 15KF
R7 15KF
R8 2.2K (1/2)
R9 4.7 (1/4)
R10 4.7 (1/4)
R11 100K
R12 100K
R13 100K
R14 10K
R15 4.7K
R16 150K
R17 4.7K
C1 0.047/250
C2 0.047/250
C3 2200/35
C4 2200/35
C5 220/35
C6 220/35
C7 0.47/50
C8 0.47/50
C9 47/16
C10 100/25
C11 100/25
C14 2200/35
C15 2200/35
C16 0.1
C17 0.1
C18 47/25
C19 47/25
C20 0.1
C21 0.1
C22 10/35
C23 220/25
C24 220/25
C25 0.047/250
C26 0.047/250
C27 4700/25
C28 6800/35
C29 1/50 BP
C30 3.3/50
C31 1/50
C32 47/25
C33 1/50 BP
C35 47/35
C37 4700/25
C38 1000/6.3
C39 0.1
+15V
-15V
+5V
6V
P2-4 +15V (A)
P2-5
P6-1 +15V (P)
P6-2 G (P)
P2-6 GND (A)
P2-7
P6-3 -15V (P)
P2-8 -15V (A)
P2-9
P2-2 +15V (C)
P5-1 GND (C)
P2-3
P5-2
P2-1 -15V (C)
P4-1 PWR ON SIG
P4-6 +5V
P4-7
P4-2 GND (5V)
P4-3
P5-4 +B (CM)
P3-5 +B (R.M)
P3-6
P4-5 R.M.FL
P3-1 +B (SOL)
P3-2 GND (SOL)
P4-4 SOL.FL
P3-3 GND (R.M)
P3-4 GND (R.M)
P5-3 GND (C.M)
*1 : EUR, UK, AUS ONLY
*2 : EUR, UK, AUS -T2.5A 250V
*3 : EUR, UK, AUS -T6.3A 250V

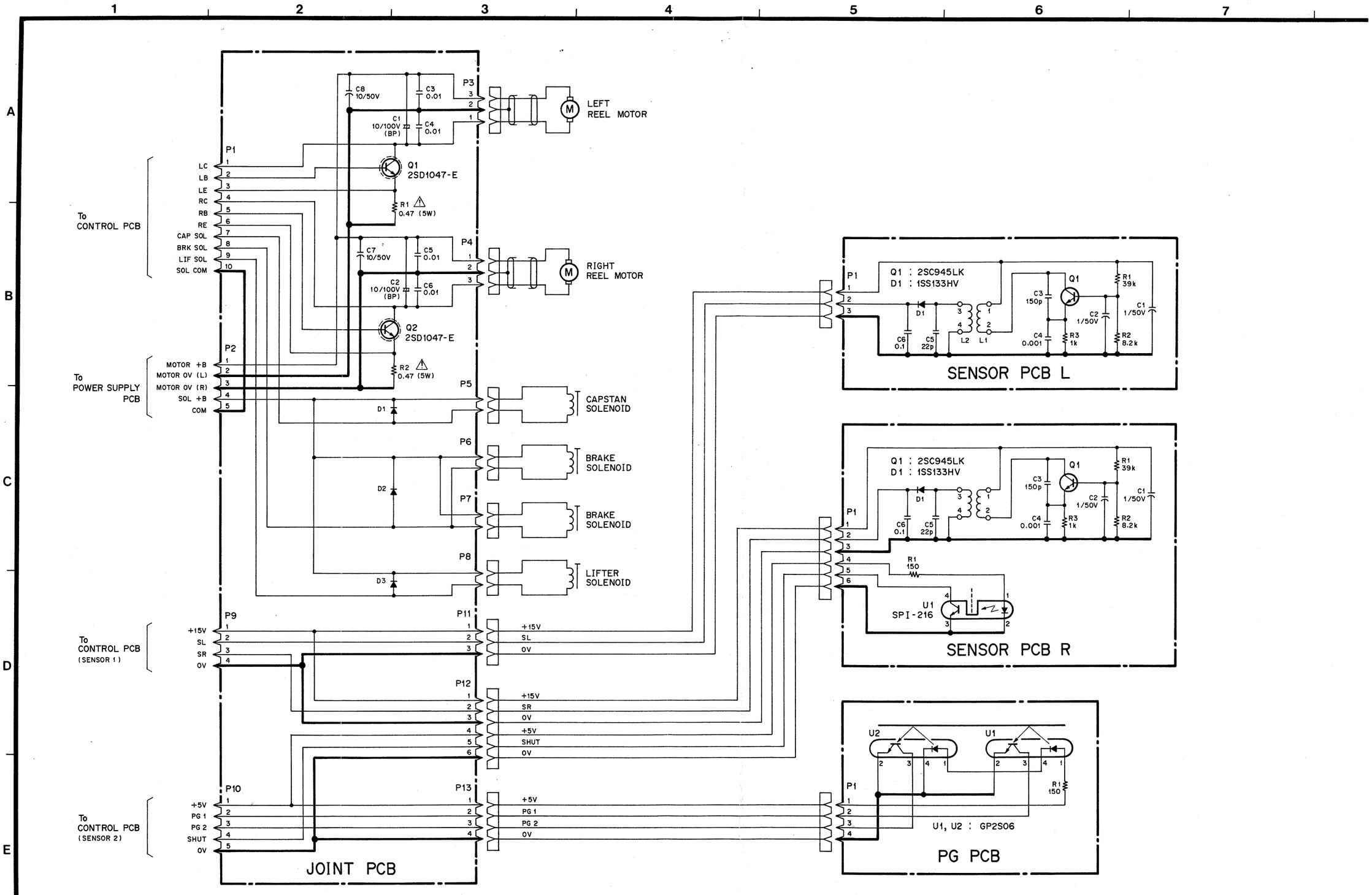


U1 U2 : TC4011BP
U3 - U10 : DTA124ES
U11 - U13 : DTC124ES

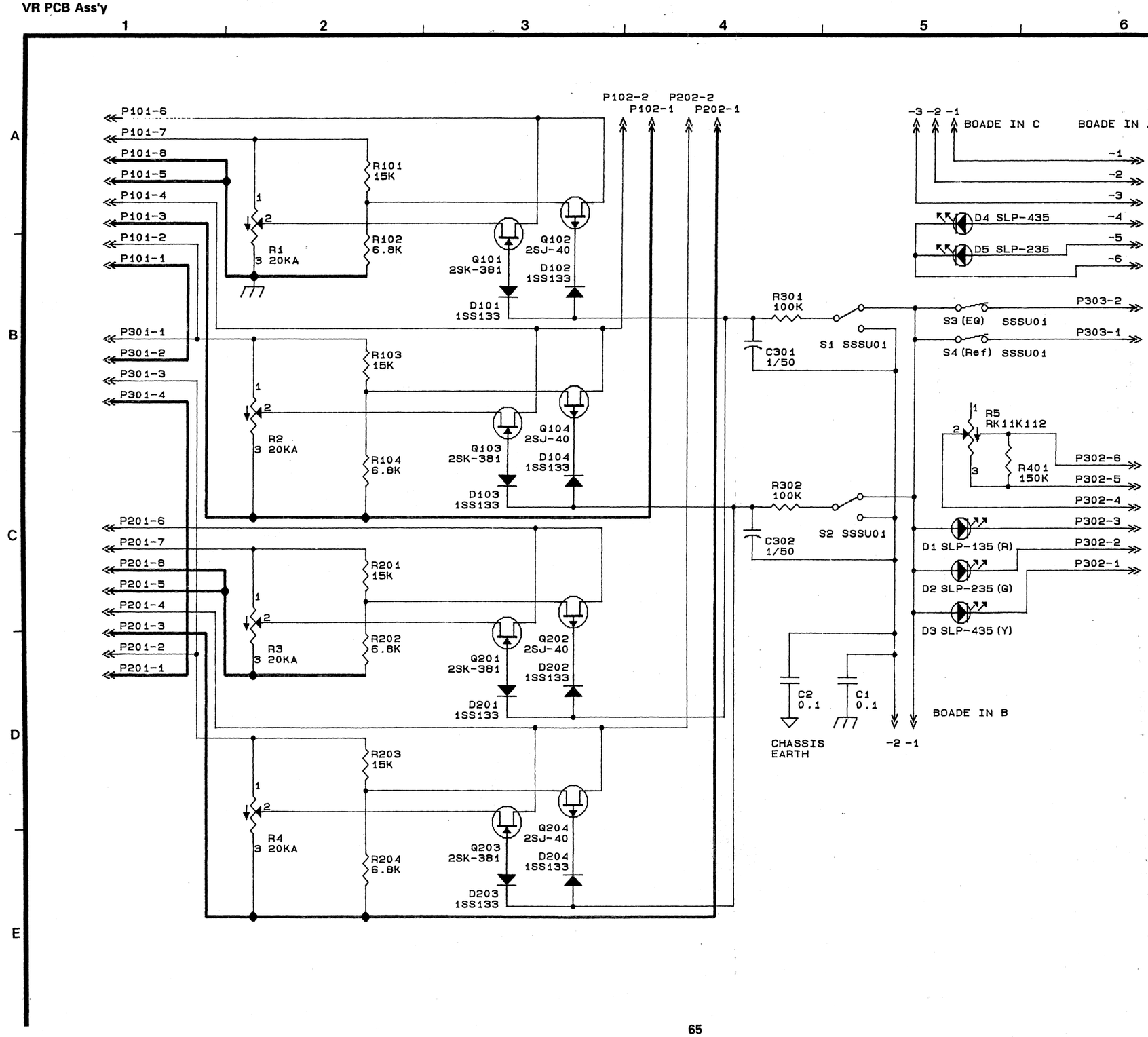
TC AMPL PCB Ass'y [-20T ONLY]



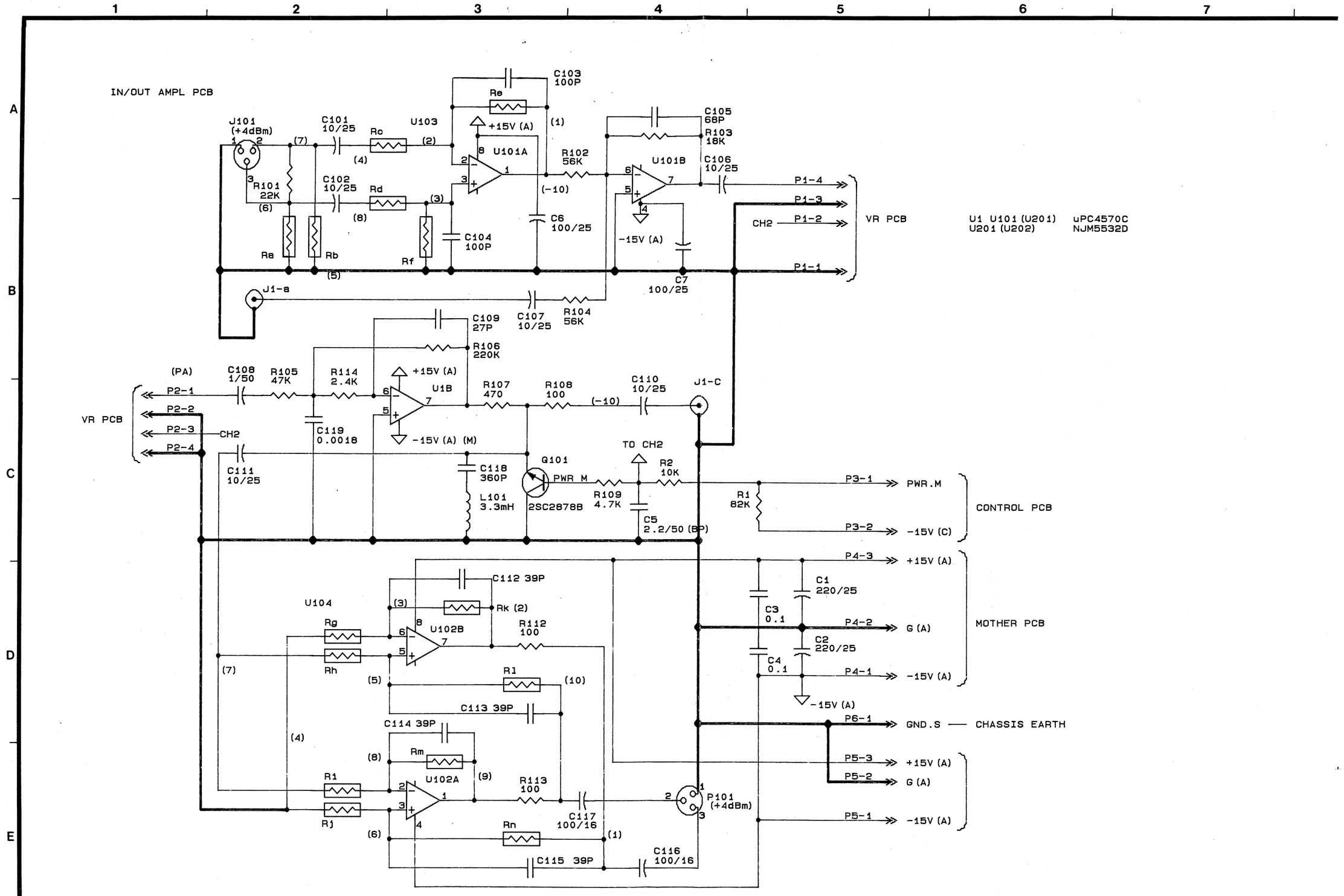

CAPSTAN MOTOR
FG 1
FG 2
(RED)
P1
TR PCB
Q4 2SD1913
Q
Q3
P2
To POWER SUPPLY PCB
+24V
0V (+24V)
+15V
0V (+15V)
C17 1/50V (BP)
C3 22/25V
C4 22/25V
C5 2.2/50V
C6 0.01
R1 1k
R2 47k
C7 0.47/50V
R3 100k
R4 330
C8 22/35V
U5
TP1
TP2
C9 0.001
C10 0.001
C11 0.22 (TF)
R5 330k
R6 22k
R7 1k
R8 47k
C12 0.022
C13 0.022
R9 20k (METAL FILM)
U1
LOW
HIGH
Q1
Q2
(METAL FILM)
R10 20k
R11 12k
CW
R50 10k
R51 10k
U2
FIX
VARI
P3
R29 (2W) 1
R28 22k
C50 47/25V
C51 0.01 (C)
C52∿C58 0.01 (C) x7
R26 30k
EXT
R40 4.7k x4
C
To CONTROL PCB
EXT FREQ
INT/EXT
2Hz
CM STOP
VARI
SPEED L
Q5
R12 10k
R13 4.7k
C14 100p (C)
R14 10k
R15 10k
R16 10k
U7
R17 6.8k
C15 0.0015
R18 15k
C16 1μ (TF)
R19 100k
R21 82k
U6
R20 22k
R52 10k
R22 24k
R23 1.2k
R24 1M
R25 10k
R27 22k
R30 15k
GND
Q7
Q8
Q6
R31 1.5k
R33 1.5k
R32 3.3k
U4
U3
D1
D2
U1, U2 TC4066BP
U3 TC4011BP
U4 TC4001BP
U5 μPC1043C
U6 LA6358
U7 NJM4151D
Q1∿Q3 2SC2320 (F)
Q4 2SD1913
Q5∿Q8 DTC124ES
D1, D2 1SS133
CAPSTAN SERVO PCB

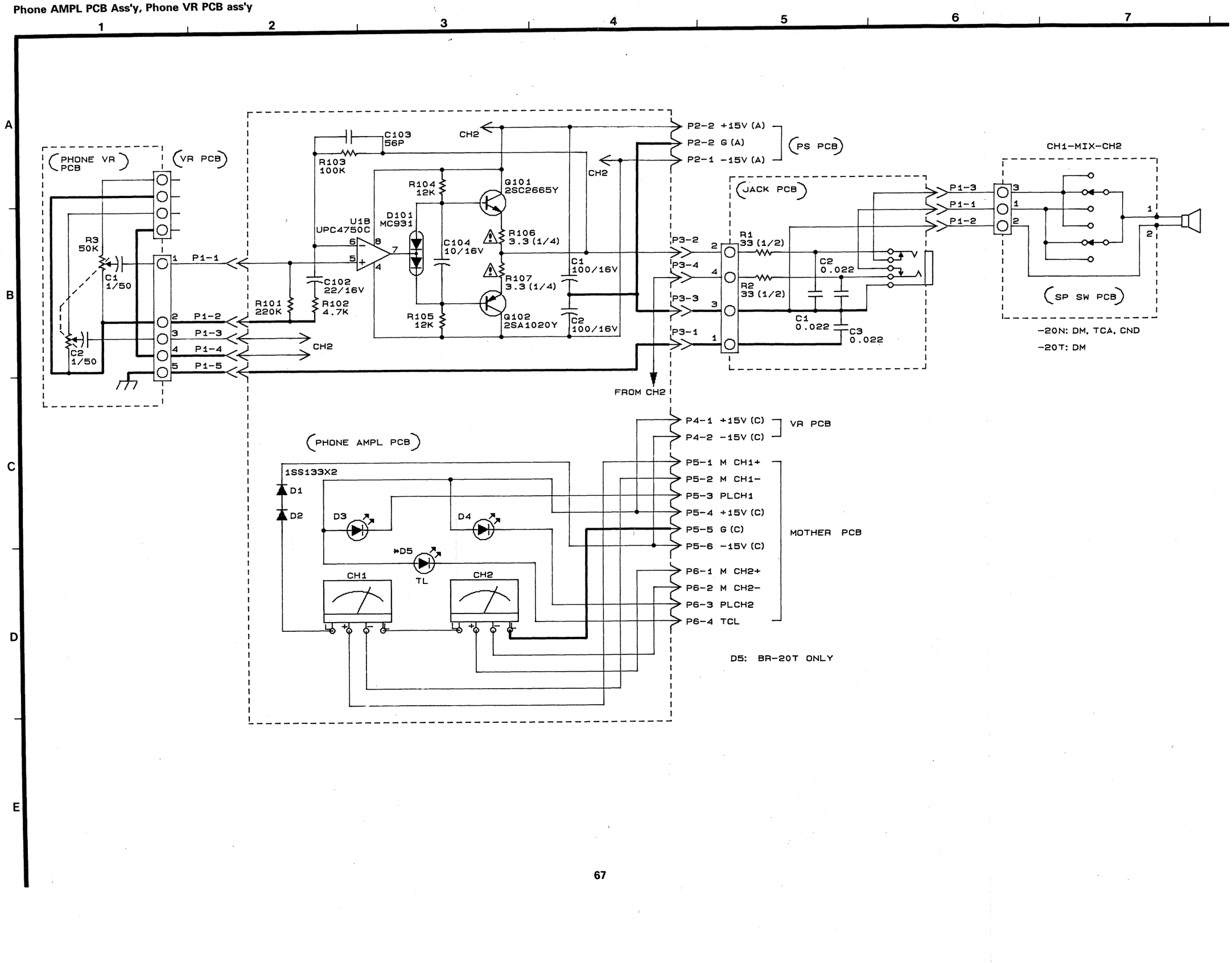

1
2
3
4
5
6
7
A
B
C
D
E
C8 10/50V
C3 0.01
C1 10/100V (BP)
C4 0.01
P3
LEFT REEL MOTOR
P1
LC
LB
LE
RC
RB
RE
CAP SOL
BRK SOL
LIF SOL
SOL COM
Q1 2SD1047-E
R1 0.47 (5W)
To CONTROL PCB
C7 10/50V
C5 0.01
C2 10/100V (BP)
C6 0.01
P4
RIGHT REEL MOTOR
Q2 2SD1047-E
P2
MOTOR +B
MOTOR 0V (L)
MOTOR 0V (R)
SOL +B
COM
R2 0.47 (5W)
To POWER SUPPLY PCB
P5
CAPSTAN SOLENOID
D1
P6
BRAKE SOLENOID
D2
P7
BRAKE SOLENOID
P8
LIFTER SOLENOID
D3
P9
+15V
SL
SR
0V
To CONTROL PCB (SENSOR 1)
P11
+15V
SL
0V
P12
+15V
SR
0V
+5V
SHUT
0V
P10
+5V
PG 1
PG 2
SHUT
0V
To CONTROL PCB (SENSOR 2)
P13
+5V
PG 1
PG 2
0V
JOINT PCB
P1
Q1 : 2SC945LK
D1 : 1SS133HV
C3 150p
Q1
R1 39k
C1 1/50V
C2 1/50V
C6 0.1
C5 22p
L2
L1
C4 0.001
R3 1k
R2 8.2k
SENSOR PCB L
R1 150
U1 SPI-216
SENSOR PCB R
U2
U1
U1, U2 : GP2S06
PG PCB

VR PCB Ass'y


1
2
3
4
5
6
7
A
B
C
D
E
P101-6
P101-7
P101-8
P101-5
P101-4
P101-3
P101-2
P101-1
P301-1
P301-2
P301-3
P301-4
P201-6
P201-7
P201-8
P201-5
P201-4
P201-3
P201-2
P201-1
R101 15K
R102 6.8K
R1 3 20KA
R103 15K
R104 6.8K
R2 3 20KA
R201 15K
R202 6.8K
R3 3 20KA
R203 15K
R204 6.8K
R4 3 20KA
Q101 2SK-381
Q102 2SJ-40
Q103 2SK-381
Q104 2SJ-40
Q201 2SK-381
Q202 2SJ-40
Q203 2SK-381
Q204 2SJ-40
D101 1SS133
D102 1SS133
D103 1SS133
D104 1SS133
D201 1SS133
D202 1SS133
D203 1SS133
D204 1SS133
P102-2
P102-1
P202-2
P202-1
R301 100K
R302 100K
C301 1/50
C302 1/50
S1 SSSU01
S2 SSSU01
-3 -2 -1
BOADE IN C
BOADE IN A
-1
-2
-3
-4
-5
-6
D4 SLP-435
D5 SLP-235
S3 (EQ) SSSU01
S4 (Ref) SSSU01
P303-2
P303-1
R5 RK11K112
R401 150K
P302-6
P302-5
P302-4
P302-3
P302-2
P302-1
D1 SLP-135 (R)
D2 SLP-235 (G)
D3 SLP-435 (Y)
C2 0.1
C1 0.1
BOADE IN B
CHASSIS EARTH
-2 -1

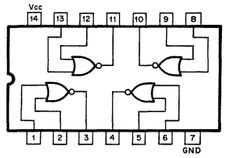
IN/OUT AMPL PCB Ass'y



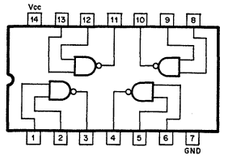

PHONE VR PCB
VR PCB
R3 50K
C1 1/50
C2 1/50
P1-1
P1-2
P1-3
P1-4
P1-5
C103 56P
R103 100K
R101 220K
R102 4.7K
C102 22/16V
U1B UPC4750C
D101 MC931
R104 12K
R105 12K
C104 10/16V
Q101 2SC2665Y
Q102 2SA1020Y
R106 3.3 (1/4)
R107 3.3 (1/4)
C1 100/16V
C2 100/16V
CH2
FROM CH2
P2-2 +15V (A)
P2-2 G (A)
P2-1 -15V (A)
PS PCB
JACK PCB
P3-2
P3-4
P3-3
P3-1
R1 33 (1/2)
R2 33 (1/2)
C2 0.022
C1 0.022
C3 0.022
P1-3
P1-1
P1-2
CH1-MIX-CH2
SP SW PCB
-20N: DM, TCA, CND
-20T: DM
PHONE AMPL PCB
1SS133X2
D1
D2
D3
D4
*D5
TL
CH1
CH2
P4-1 +15V (C)
P4-2 -15V (C)
VR PCB
P5-1 M CH1+
P5-2 M CH1-
P5-3 PLCH1
P5-4 +15V (C)
P5-5 G (C)
P5-6 -15V (C)
P6-1 M CH2+
P6-2 M CH2-
P6-3 PLCH2
P6-4 TCL
MOTHER PCB
D5: BR-20T ONLY

8-4. IC Internal Block Diagrams

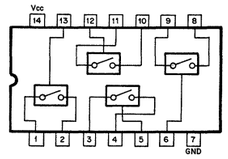
TC4001BP
QUAD 2-INPUT NOR GATES



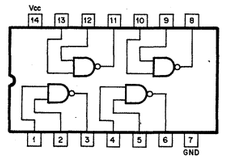
TC4011BP
QUAD 2-INPUT NAND GATES



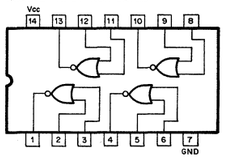
TC4066BP
QUAD BILATERAL SWITCHES



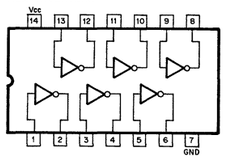
TC74HC00P
QUAD 2-INPUT NAND GATES



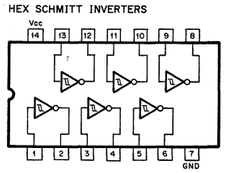
TC74HC02P
QUAD 2-INPUT NOR GATES



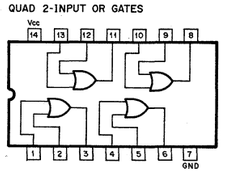
TC74HC04P
HEX INVERTERS



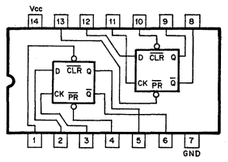
TC74HC14P
HEX SCHMITT INVERTERS



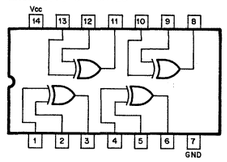
TC74HC32P
QUAD 2-INPUT OR GATES



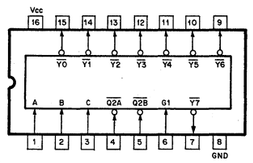
TC74HC74P
DUAL D FLIP-FLOP
WITH PRESET AND CLEAR



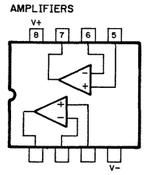
TC74HC86P
QUAD 2-INPUT
EXCLUSIVE OR GATES



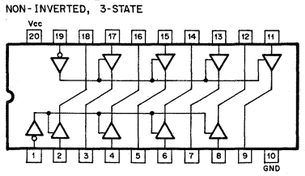
TC74HC138P
3-TO-8 LINE DECODER



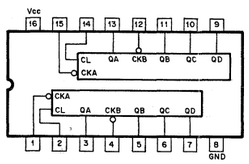
M5218P
μPC4570C
DUAL OPERATIONAL
AMPLIFIERS



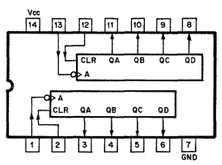
TC74HC244P
OCTAL BUS BUFFER
NON-INVERTED, 3-STATE



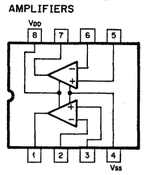
TC74HC390P
DUAL DECADE COUNTER



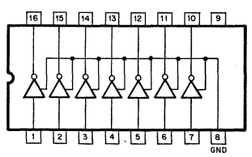
TC74HC393P
DUAL 4-BIT BINARY COUNTERS



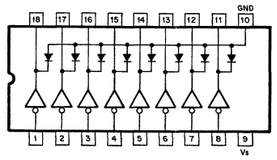
NJM5532D-D
DUAL OPERATIONAL
AMPLIFIERS



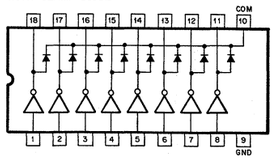
TD62504P
7-UNIT TRANSISTOR ARRAY



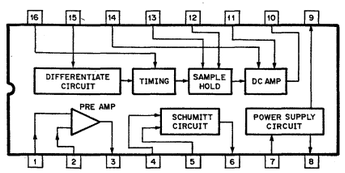
M54581P
8-UNIT 500mA DARLINGTON TRANSISTOR ARRAY
WITH CLAMP DIODE



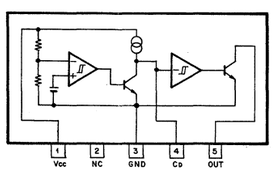
M54585P
8-UNIT 500mA DARLINGTON TRANSISTOR ARRAY
WITH CLAMP DIODE



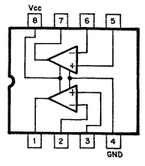
μPC1043C
F. G. SERVO



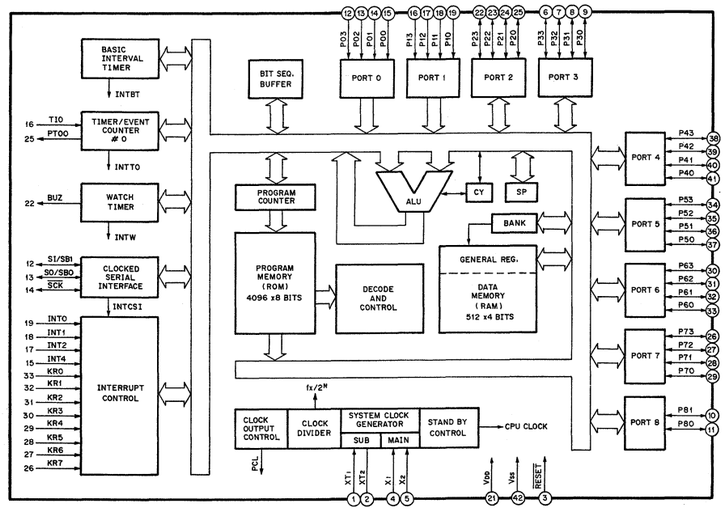
M51953BL
μP RESET



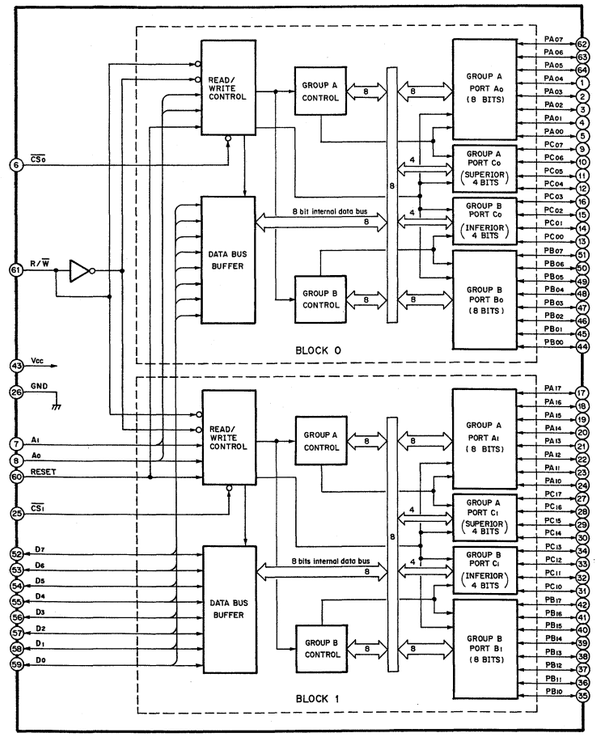
LA6358
DUAL OPERATIONAL
AMPLIFIERS



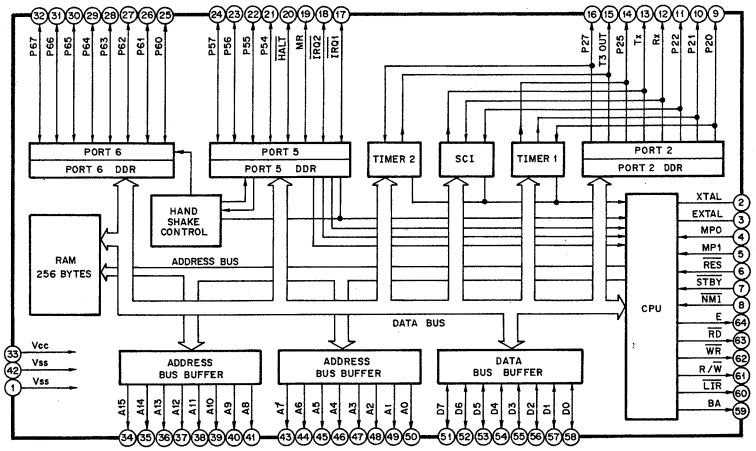
μPD75004
CMOS MPU



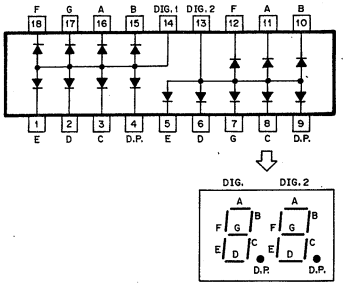
M5M82C255ASP
CMOS PROGRAMMABLE PERIPHERAL INTERFACE



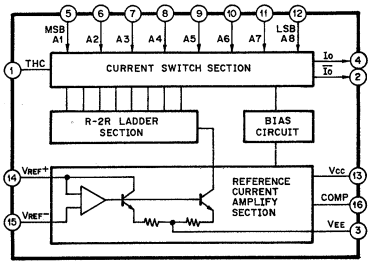
HD63B03YP
CMOS MPU



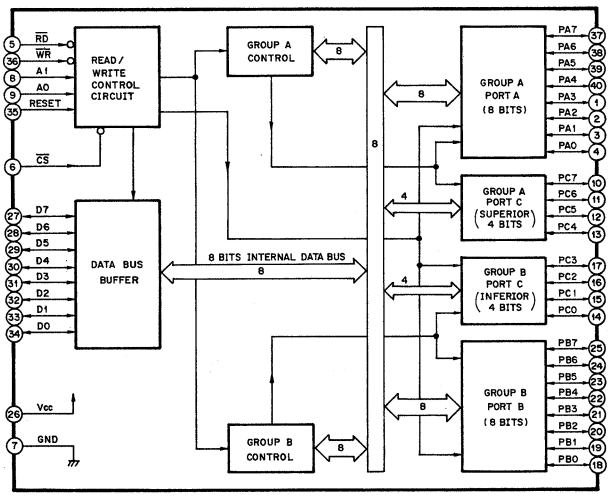
GL-7D201
NUMERAL DISPLAY



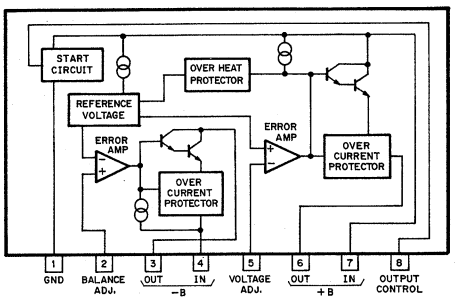
HA17008RP
8-BIT MULTIPLYING DIGITAL-TO-ANALOG CONVERTER



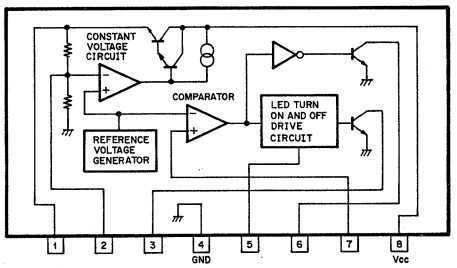
M5M82C55AP-2
CMOS PROGRAMMABLE PERIPHERAL INTERFACE


READ / WRITE CONTROL CIRCUIT
GROUP A CONTROL
GROUP B CONTROL
DATA BUS BUFFER
8 BITS INTERNAL DATA BUS
GROUP A PORT A (8 BITS)
GROUP A PORT C (SUPERIOR) 4 BITS
GROUP B PORT C (INFERIOR) 4 BITS
GROUP B PORT B (8 BITS)
RESET
Vcc
GND

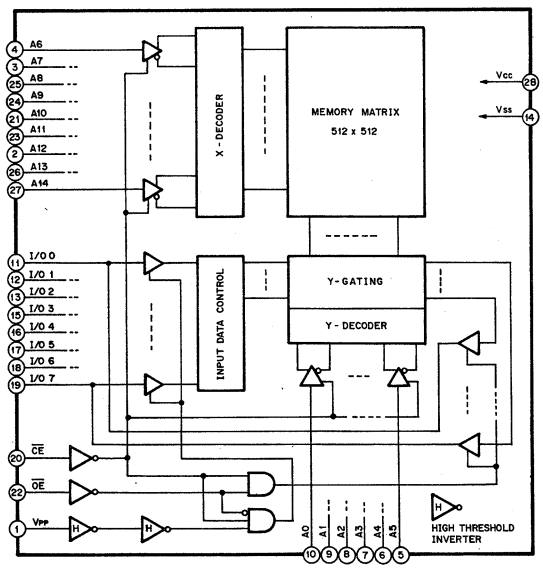
M5230LA
REGULATED VOLTAGE SUPPLY



M5232L
VOLTAGE DETECT ALARM CIRCUIT



HN27C256G-20
32768-WORD x 8-BIT UV ERASABLE AND PROGRAMMABLE ROM



NJM4151D
V-F/F-V CONVERTER